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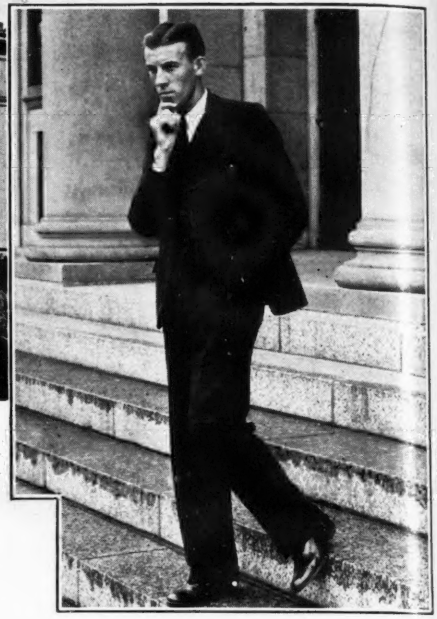

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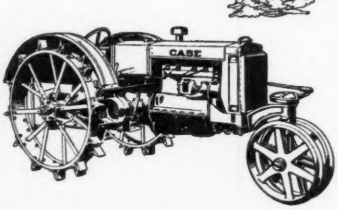

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Vol. 11 — OCTOBER, 1930 — No. 10

CONTENTS

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The Need for Research in Farm Structures

By J. L. Strahan[1]

J. L. Strahan

According to a preliminary report of the director of the farm structures research survey conducted by the U. S. Department of Agriculture in 1929 and 1930, present farm construction in the United States represents an investment of approximately 11¾ billion dollars. Estimating depreciation and taxes conservatively at 6 per cent it requires an annual outlay of over 700 million dollars just to maintain this investment intact. In addition, new construction is being completed every year at a probable cost of many millions more. Truly this problem has real economic significance in the agricultural scheme of things. In fact no other item of agricultural investment except that in the land itself approaches it in magnitude. And yet it is the one that has received no real attention from public research agencies either from the economic or the engineering approach. Why?

In attempting to analyze the problem to discover reasons for this unfortunate situation, one is confronted with the peculiar fact that, in spite of the immense total amount of money involved, no individual or group of individuals is technically responsible for the adequacy of farm building design, excepting only one. That one is the farmer himself, and he is not, and cannot take the time to be, technically trained. This was all right so long as production methods did not call for the solution of technical problems in the design or construction of the various buildings required. In the old days a farmer was a jack-of-all-trades and his technique was entirely adequate for the solution of the comparatively simple problems that he had to meet and solve.

Times now have changed. Strict control of all factors of production is demonstrating that a closer attention to technical detail in design is economically necessary. The farmer is being asked to think in terms of B.t.u., storm sash, area of wall exposure per animal unit, caloric value of feed rations, electrification, building arrangement and organization for labor economy and any number of other such trying details. But he is so busy producing that he has no time to learn how to use this newer technique to produce most economically. He is not technically trained and in the nature of things he cannot be technically trained to the point where it is safe for him to use his own judgment.

Farmers do not yet have the services of agricultural engineers; however, there is no doubt as to the need for technical service in this field, and where there is a need there is usually developed a means for meeting it. Therefore, engineers must be developed and farmers must be educated to see the value of using them.

Because no individual or group of individuals is technically responsible for the adequacy of farm construction is no reason to suppose that no individuals or groups of individuals are interested. Plenty of people are interested but none are responsible. Is there any wonder then that the problem has not been apparent? Is there any wonder that no one has up to the present been able to show just how farm buildings are related to the general scheme of agricultural production, when this relation has been obscured, unintentionally perhaps but none of the less effectively behind a smoke screen of divergent opinion and conflicting interests? Let's drag this problem out into the light and look it over.

The amount of money involved in farm construction throughout the country is large. But the individual project is small, anywhere from $500 to $5000 on the average and probably the larger number near the small end. This is not much compared to $35,000 for a new post office or $150,000 for a new high school. Inasmuch as the man who retails the building material has interest in the project in proportion to its size, it is easy to see that while he undoubtedly wants to sell the lumber for the chicken house or milk house or stable, he doesn't want to badly enough to go into design technicalities beyond what is absolutely necessary to get the business. The irreducible minimum. Nor is there really any good reason why he should. The larger material interests, however, lumber, cement, brick, and tile, etc., see the market as a whole. They see the 700 millions, not the individual $500. They are the ones, therefore, who have undertaken to supply the local dealers with the "irreducible minimum" of technicalities that he needs to get the business. Bulletins, plan books, blueprints with bill of materials—all standardized and all "best"—clutter the offices of the local lumber yards, and the information therein contained is handed over to the farmer without question, except perhaps first to determine which material carries the most profit. Unless the information is sound, how does this profit the farmer?

This is not a matter for censure of the materials interests. They have done the only thing possible under the circumstances. They have used the only information available and have conscientiously attempted to have it right. The very fact, however, that they all respond most enthusiastically to every effort that has been put forward to develop cooperative research in this field leads to the suspicion that they are fully alive to the lack of the very material that would make their efforts at extension 100 per cent effective. They are an extension agency functioning in advance of research and they realize it. Therefore, they want research. Research that will develop such information as will be generally agreed upon as safe to place in the hands of their distributors. Such a general agreement is going to reduce the resistance to sales tremendously because for any given use all extension agencies whether industrial or institutional will be advising the same or comparable construction. The farm-

[1]Agricultural engineer, Louden Machinery Company. Mem. A.S.A.E.

An outside view of the barns on C. W. Miller's "Shawan Farm" at Cockeysville, Md.

er will be getting a straight story from all sides and will therefore be much more in a buying frame of mind.

The materials people are not the only ones interested in this little item of 700 million dollars. Equipment manufacturers want their share too. To which they are justly entitled. But how do they fit into the picture? Before equipment for a stable can be specified accurately enough to enable the factory to prepare it for shipment, the plan of the stable in which it is to be erected must be worked out in detail. Of course this planning is the farmer's job. He is supposed to tell the manufacturer just where he wants his stalls or pens or what not, and the manufacturer is supposed to furnish just that, no more and no less. But there is a serious hitch in this program that isn't at first just clear. Individual farmers' requirements are all different whereas the manufacturer's requirement is, if he is to keep down costs and sell successfully in a highly competitive market, to simplify and standardize. These two opposing interests must be resolved to the satisfaction of both parties before a deal can be consummated. Now because the manufacturer is constantly in contact with many different problems he gradually accumulates a mass of information that enables him to speak with a certain degree of authority to a new customer, who in turn comes to accept him as such. Hence in the course of time instead of the farmer telling the manufacturer just what he wants, the manufacturer assumes the role of specialist and tells him what he should have. And it isn't surprising that he tells him in terms of simplified and standardized equipment. Please bear in mind that the manufacturer is not to be criticized for this. There is no evidence at present available to show that the extension service he renders is not of the highest order of engineering and technical excellence. On the contrary there is plenty of evidence that a good share of it is. But it is still a fact that equipment manufacturers as a whole, so far at least as the farm building problem is concerned, constitute an extension agency of vast proportions, an extension agency functioning in advance of controlled research, using the farm public as a huge laboratory on which to try out new devices and new methods.

In fact, I presume that these manufacturers come as near to constituting a really effective extension agency for disseminating information in farm building design as now exists. It is probably true that not less than 500 men are traveling through this country constantly in touch with persons who actually spend money to build barns of one kind or another. Each of these men is given a short-course of training by the organization he represents and is instructed to sell goods through the service he is prepared to render. It is not proper to say that these engineers are not adequately educated. It doesn't take very long for a bright young man to prepare himself in a field in which one man's guess is admittedly as good as another's. It is enough to consider that this young army of farm building experts is a tremendous potential power for either good or evil; good if they can have access to sound information developed through adequate research, and quite the contrary if they can not.

Then there is still a third party interested in the 700 millions. The man who actually builds the barn. Sometimes he is an old-timer who insists on framing the way his grandfather taught him and who is constitutionally opposed to "newfangled" ideas. If not that, he is a general contractor who has just come from half a hundred different kinds of jobs, store fronts, bank buildings, town houses, schools, miniature golf courses or what not, and who does not pretend to be a barn specialist. His structural details are usually excellent but his knowledge of farm building "use requirements" is way below zero. Furthermore, when he contracts on a cost plus basis, his interests lie largely in the "plus."

So it would seem that the only one who has a definite interest in the final product of the building project is the farmer. Unfortunately, however, he is unable clearly to define this interest in terms of economics and engineering. He knows he wants something but he doesn't know exactly what. And he gets something, which may be precisely what he needs but which most likely is not. If, then, he is hazy in his own mind as to what he wants, if materials interests are concerned principally with the sale of structural materials, if manufacturers are concerned principally with the profitable sale of equipment, and if the man who fabricates the materials and installs the equipment is interested principally in seeing a reasonable margin of profit as a result of his endeavors, then it is not to be expected that the structures problem as a whole can be seen only with the greatest difficulty, if at all, and is it to be wondered at that it has not yet been brought to the attention of the proper research agencies with sufficient force to warrant them organizing a comprehensive scheme of research in this field?

Once in a great while a hard-boiled, hard-thinking experienced farmer knows what he wants and gets it. But there are millions who are inexperienced, not so hard thinking as they might be, and who are not overly endowed with that peculiar characteristic stubbornness or mulishness popularly glorified nowadays as "sales resistance." These millions have but two disinterested sources of help, namely, state and federal governmental agencies and the architectural profession. When they go to these sources, what do they get?

From the federal and state agencies they get the personal opinions of those who, in the first place, are unable, because of lack of funds, to study the problems adequately, and who, in the second place, are not in a position easily to say "I don't know" for the simple reason that they are hired to know. A tough position

to be in if there ever was one. The opinions these people offer may be good and they may be bad, but, through no fault of their own, they are not to be relied on. Some of my best friends, in whose opinions I have a great deal of confidence, disagree on fundamentals. They can't all be right and differ at the same time. That's why they are not at present to be relied on. These governmental agencies are unquestionably doing the best they can under conditions that make a really satisfactory job impossible. Nor is it because they can't get support. Not at all. But rather because they haven't really defined their own job. One good friend of mine wants some Messiah to rise up and paint a plowing picture of the problem that will literally make the legislatures and Congress weep money for research. Another wants to start something, no matter how small and prove by definite results that a reasonable expenditure is logical and desirable. Others are actually doing work on a shoestring at odd times, and I firmly believe will definitely prove not only the desirability but the urgent necessity for adequate support. I'm for both lines of attack. If we can find the picture painter, let's use him. But if he doesn't show up in time to inspire us before we pass out of the picture ourselves, let's do the other thing. A definite program worked out for a limited field will go far toward demonstrating the value of proper research to those empowered to inaugurate it.

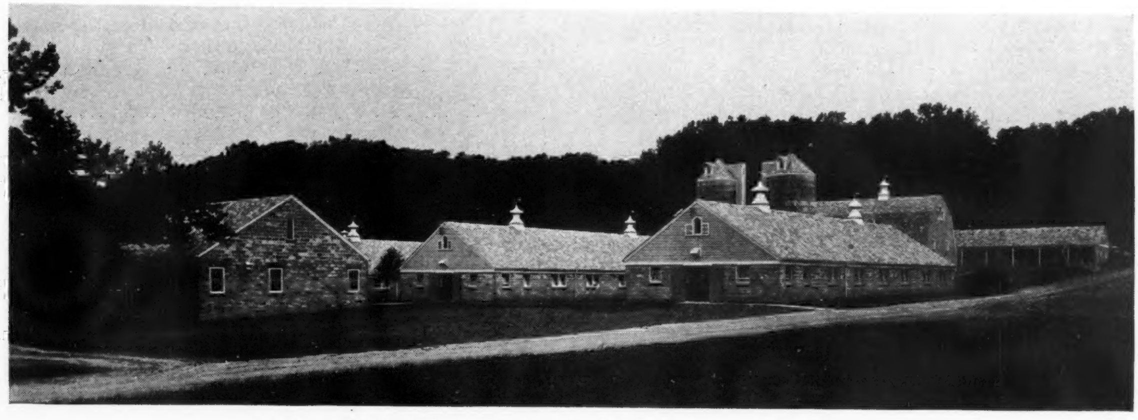
Now what does the business farmer get when he goes to the architectural profession? He gets nothing unless the architect is in a starving condition, and then what he gets is just a shame. As a matter of fact the successful architectural practitioner has no time for him. And the unsuccessful one has no knowledge of the agricultural engineering principles involved in farm building design. This situation is exactly what is to be expected. The farmer himself is so ignorant of the economic status of his building program that he wouldn't hire the most competent agricultural architect in the world, if there was one, principally because he thinks he can't afford the fee.

There is food for thought in that statement. The farmer is not to be blamed for not hiring an advisor to help him in his farm building problems when there is no advisor. And if there were, you couldn't intelligently expect him to hire one if he couldn't see the value of the service. At the present time he doesn't even know the value of his buildings, let alone the value of advice on them. All he knows about them is their first cost. And that specter of first cost is simply hideous to the fellow who works hard for a small margin of profit. Does that not suggest the line of attack for a research program? And does it not also open up the road we must travel if we are to build anything like a sound mass of professional technical information that will put the agricultural engineer where he should and must be, namely, on the same plane as the architect; that will make him a necessity in the modern scheme of agricultural production earning his own way through the value of his service? To me it suggests the following: First, establish research projects to determine the economic status of farm buildings; second, establish projects to develop proper and adequate design data—agricultural engineering technique.

Consider first the economics of the situation. What percentage of the total cost of agricultural production is represented by the use of buildings? What effect will increasing this present percentage have on other cost factors? What will be the effect of decreasing them? In other words, what is the value of the farm buildings in terms of greatest returns through their use? When this is definitely shown and the truth of the matter generally known, first cost as the limiting factor is going to fade out of the picture. It will take plenty of effort to determine this truth and plenty of ingenuity to present it convincingly to the general run of business farmers after it is worked out. But when the result is finally accomplished, farmers are going to get more value from their buildings, more good building materials will be used where and how they should be used and more building equipment of the kind that has economic justification will be in demand. Agricultural production costs will be reduced and allied industrial volume of business will be increased. A satisfactory situation all around.

Agricultural engineering technique, knowledge of methods or ways and means for proper design, is lacking. Ask any agricultural engineer what in his opinion constitutes the special problem involved in designing a stable for livestock that could not be readily handled, after a short period of investigation of the available literature, by an ordinary practicing architect. I doubt if he could tell you offhand or even after some little cogitation. Perhaps there is no such special problem, and perhaps it is true that the only reason the architect has not been interested is that he has seen no profit in it for himself. I do not think this is so myself. I think there are factors to be considered in the design of such a building that would never occur to the ordinary architect as existing. I think these factors constitute the technical material that sets this work off in a separate professional field. I think the agricultural engineers working in the structures field constitute just as distinctly a separate branch of the architectural profession as do the men who specialize in public buildings, or small dwellings or corner filling stations.

Specifically, what do I mean by agricultural engineering technique? If you will try to list out for yourself



The "Shawan Farm" barns seen from a different angle

Interior view of a stable on the one hundred fifty-cow dairy farm of C. W. Miller, Cockeysville, Md. Business farms of this type especially need to know the relation between their building costs and their total production costs

the "use requirements" of only one of the animal shelter structures you will be led into paths that the architect never treads—doesn't want to tread—is not fitted by his training to tread and will tread only if his personal inclinations lead him through them in spite of his training.

Consider a dairy stable for instance. Its primary function is to house milking cows. It is not to furnish storage for feed and hay nor is it to store and handle milk after it is drawn. It is not to provide certain passage-ways to and from feed, milk room and cows. All these elements of the problem could be taken care of without walls or roof. A concrete floor equipped with stalls, stanchions and watering equipment, flanked on one side by a pile of hay and feed and on the other by a milk cooling vat would admirably serve all these purposes. And the expense of walls and roofs would be eliminated. There is only one reason for enclosing and roofing in that concrete floor and it can be summed up by just one word: Weather. If it never got too cold or too hot or if it never rained or snowed or if the wind always confined itself to a gentle zephyr, then we could save a large part of the first cost of building construction and still be exactly as efficient in our methods of extracting the milk from the cow. But we all know what the weather is. Mark Twain said that although everyone kicks about it, nobody ever really does anything about it. I can't agree with him at all. Every man who builds himself a house or his cows a barn does something very substantial about it. The only point to be considered is, how well does he do it, and the vital question before our friends interested in structures research is how well does he need to do it?

Is it enough to provide merely a crude shelter to break up the worst of winter winds? Shall we close in the barn on all sides and try to keep it from freezing? Or shall we produce such a nice adjustment between heat production by the cows and heat loss from the building that comparatively uniform temperatures will exist throughout the winter? Or shall we go even further and lower the temperatures in the summer time by means of artificial refrigeration, thereby holding a uniform temperature year round? Somewhere between no control and complete control is a point where expenditure will be justified by returns in the milk pail. I am certain that in some sections what is ordinarily considered a good barn is not adequate. An organization producing certified milk in Wisconsin, milking between 600 and 700 cows suffers a drop of 5 per cent in the daily milk flow during a sudden cold snap. No records are available to show just how the temperature in these barns varied. but this is beside the point at present. We know that temperature variation of some kind resulted in a considerable loss. Five per cent of the milk from 650 good cows in terms of sales of a certified product amounts to something like $60 to $70 per day. Ten days of such loss during the winter would amount to interest on a very considerable investment in housing and control equipment. Savings in feed that might be made if stable temperatures could be controlled, and reduction in herd depreciation through prevention of respiratory diseases are benefits that would accrue in addition. Unquestionably there is work to be done here.

Now the factors involved in the problem of providing the correct degree of control are those with which the agricultural engineer is particularly concerned. Their proper manipulation requires the use of data of distinctly agricultural engineering significance, design constants and factors that the practicing architect has probably never heard of. What architect can tell us the conditions of temperature and humidity conducive to the most efficient production of milk by the justly celebrated foster mother of the human race? How many heating and ventilating engineers can tell you offhand, or even go to their handbooks and find out, what the rate of heat and moisture production by a cow in full milk flow is per hour? Or the goat, hog or hen? Yet if atmospheric environment is to be controlled these constants must be carefully considered. They must be considered in a very definite relation to building construction details as well as to climatic conditions.

We must admit at this point that agricultural engineers cannot go to their handbooks either. They are quite as much in the dark as the architect or the ventilating engineer, except for one thing—that they are conscious of the lack, know it must be supplied before they can be considered as members of a going profession, and know how to go about remedying the situation. By research—always research—and research by the properly constituted public agencies.

Is it necessary to say more? With powerful industrial organizations acting in an extension capacity, circulating material of questionable value, with the regularly constituted agricultural extension agencies in a position neither to acquire adequate material nor to say "I don't know," with the farmer himself hazy in his conception of factors vital to the successful conduct of his business and with an embryonic profession practically entirely devoid of a fundamentally sound technique, can there be any question as to the vital need for the inauguration of a comprehensive and well-coordinated research program in the farm structures field? I ask you.

Economic and Engineering Problems in Farm Fencing[1]

By F. A. Lyman[2]

IT SEEMS that fencing has seldom been regarded as a subject or problem of sufficient importance to warrant any considerable study on the part of agricultural research agencies, be they engineering or economic in character. When fence has been thought of, it has been to wonder how we might get along with less or do away with it entirely. It has taken its place in the minds of the farmer, the teacher and the research man similar to that occupied in the mind of a grocer by sugar and flour—a staple, necessary commodity, but nothing to get enthused over.

Yet fence is almost as basic as the soil itself in most of our systems of farming and over the major part of our productive agricultural area. To the structures man fence is of great importance, for without fence there is but little need for the income-producing portion of farm structures. The magnitude of the fence problem at present is spotlighted by the fact that from 25 to 50 per cent of existing fences, averaging around 30 per cent the country over, are entirely inadequate to turn livestock.

We have made surveys in 20 states and have a fairly accurate picture of the kind, extent and condition of fences as they now exist. This survey shows that approximately one-third of the fence, ranging from 25 per cent in some cases to as high as 60 per cent in others, is totally unfit for the purpose for which it was intended. Based on an economic life of 15 years, which our surveys have shown is about as long as fence can be expected to last without excessive repair cost, the percentage of poor fence should be approximately 6.6 per cent. This gives a bird's-eye view how far neglect of fences has been carried. As engineers you will be only casually interested in these data, but they will have some value to you in estimating the size of the job involved in adjusting fence construction to fence need.

To put the existing fence lines back into effective service as livestock barriers will require an average of between 2 and 2½ rods of new fence for every acre in the corn belt and much of the adjoining regions.

[1]A paper presented before the Structures Division of the American Society of Agricultural Engineers, Chicago, December, 1929.

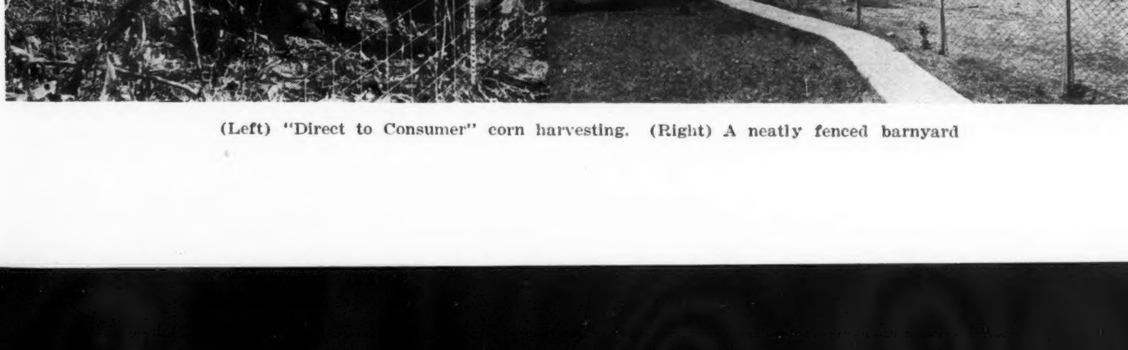
[2]Formerly managing director, Farm Fence Institute. Assoc. Mem. A.S.A.E.

To what extent these fences should be rebuilt on existing lines; to what extent they should be relocated; to what extent they should be abolished entirely; to what extent they should be augmented by additional fences, and to what extent present fences should be replaced by fence of a better type are distinctly economic and engineering questions, and as structures men it is of vital importance in your work.

Now to take up in more or less detail some of the outstanding economic and engineering problems of fence which need study and solution. In the first place, the farmer is not fence-conscious; he still regards fence as a necessary evil in 90 per cent of the cases and sees in fence or fence repairs nothing but an expense which returns no profit. As I said before, this is a psychological situation and does not indicate that there is a sound economic reason for neglecting fences. It is merely a case of other products being made more attractive to the farmer, and, consequently, he neglects one of his greatest income-producing items of equipment.

In considering the economics of fencing, we find that the first and probably the most important and more comprehensive problem is to find the income-producing value of fence in different farming systems. In other words, how much will a dollar invested in fence be expected to return the farmer who made the investment? If he specializes in hog raising, the figure may be one amount; if he is a dairyman, it may be another. Animal husbandry experiment station tests have shown, for instance, that hogging down corn is a profitable practice from two angles: first, that it saves the labor of husking the corn, and, second, that it produces more rapid and more economical gains when it is properly supplemented with the necessary protein. Again, barb wire is quite largely used by dairymen at the present time, although the trend in new fence building is unmistakably toward the use of woven wire and heavier woven wire than has ever been used. It does not take long to lose the cost of a good woven wire fence if a valuable dairy cow crawls through some shaky barb wire and gets badly torn and cut. In many cases dairying can be properly supplemented with hog raising and this, of course, calls for woven wire.

What is the income-producing value of poultry fence? Now that the poultry husbandry men have definitely



(Left) "Direct to Consumer" corn harvesting. (Right) A neatly fenced barnyard

ascertained that the greatest poultry profits are obtained with the sanitary method of handling chickens, turkeys, and other poultry this problem affects directly the use and design of the poultry houses in which you are interested, just as the use of the McLean County system involves a problem in designing the proper kind of shelter for hogs. When data of these kind are assembled and we can tell quite accurately how much a dollar invested in poultry fence or hog fence or any other kind of fence will return on the investment, it is going to be a lot easier to show the farmer that fence is something more than a necessary expense.

Then there is the question of the relation of fence to profitable livestock production. In many places in the East, and I am thinking of Lancaster County, Pennsylvania, especially, as I had an opportunity of making a visit there last spring, cattle are kept shut up in the barn the year round because the farmers feel that they can make a greater income by raising cultivated crops on all of their land and feeding the cattle in the barn. On the other hand, recent experiments by the U. S. Department of Agriculture, various state colleges and by the National Fertilizer Association show that pasture can be made one of the most valuable crops on the farm. The U. S. Department of Agriculture, for instance, found that the labor cost of producing one ton of digestible nutrients in the hay-grain rotation is 20 times as much as the labor cost for the same amount of feed in the form of good pasture. Records from New York show that cows on pasture during the summer months return a profit of 24 cents a day on the milk sold. During the winter because of the high cost of feed, there was an actual loss of 4 cents a day. This is due in a large measure to the small labor cost of maintaining pastures. Experiments in Florida have shown a net return of $7.82 per acre from improved pastures grazed by beef steers. Seventy-two experiments of the National Fertilizer Association carried out in 10 states last summer show that the cost of pasture on a moisture-free or dry feed basis under a proper system of pasture management is half the cost of corn silage or clover hay fed in the barn and one-fourth the cost of concentrates. This system of pasture management, as most of you undoubtedly know, involves the use of necessary fertilizer on the pasture and the use of fence to divide the pasture into three or four fields or paddocks for rotative grazing. In many cases in New England these experiments show that a net profit exceeding the present selling price of the land can be obtained annually by such a system of pasture management. Furthermore, the use of this system enables the grass to obtain a two-week or month earlier start in the spring and thus eliminates just that much labor and feed cost in barn feeding.

Essentially, the use of fence to enable livestock to feed itself is an application of the assembly line principle which has revolutionized American industry in the last 15 or 20 years. The more fully this system can be applied to agriculture, the lower will be the cost of production and the greater the profits.

Then comes the question of the relation of fence to the maintenance of soil fertility. It is a commonly accepted idea that a livestock system of farming tends to increase and protect soil fertility as compared with a straight system of grain farming. It has, of course, been proved that grain farming can be made permanently profitable, but it has also been proved that the same system of grain farming supplemented by livestock enterprise will be just that much more profitable due to the more economical utilization of feed and the increase in labor income which is thus made productive throughout the greater period of the year.

Recently published data from the Ohio Agricultural Experiment Station show that over a period of 18 years, during which the project has been carried on, that a livestock system of farming produces consistently higher yields than grain farming. The average for the 18-year period shows a difference of corn yield in favor of livestock farming of 6.73 bushels per acre, soy beans 2.8 bushels per acre, and wheat 4.51 bushels per acre, while clover yielded an average of 2.46 tons per acre.

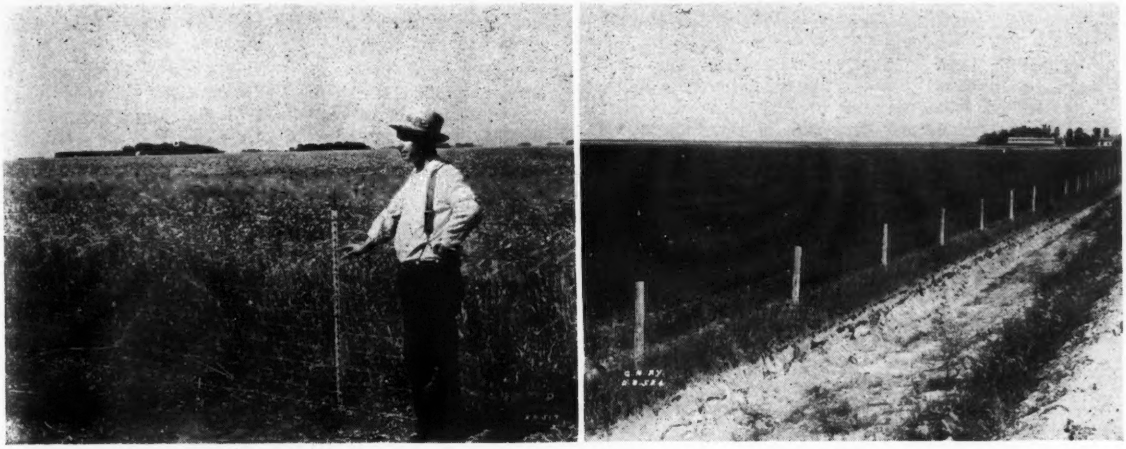
In every instance, the crop yields in livestock farming have exceeded grain farming. Taking the average of the full period of 18 years, the yields of corn have exceeded the grain farming yields by 9.8 per cent; the yields of soy beans by 14 per cent, and the yields of wheat by 17.4 per cent. The crop yields in both systems of farming are increasing due to better crop rotations, the use of fertilizer and better tillage methods, but the livestock system of farming maintains a consistent lead over grain farming. I say that this is livestock farming—more properly I should say that it is grain farming with livestock enterprises included. In addition to the gain in crop yields, there is the gain usually experienced by feeding out the crops and marketing them on the hoof and the gains made possible by utilizing by-products, such as crop wastes and residues.

Throughout a large area of the country where soil fertility is a vital problem—and there is scarcely any part of the United States where it isn't a problem any more—we find that the colleges and experiment stations are advocating a crop rotation system to include the legumes and cover crops. In order to make it at all profitable to raise these crops, livestock is necessary to utilize the roughage. In the Northwest, the old South, and the Southwest there are not sufficient fences of any kind or description to make possible the inclusion of livestock in the farming enterprises at the present time. Therefore, fence must be installed before the soil-saving and soil-building methods can be adopted. Here is another place where the necessary expense idea, with which the farmer regards fence, prevents or discourages the adoption of these better practices, as he thinks of the investment required for fence and decides that he will just struggle along in the same old way.

The relation of fence to labor economy is an interesting study. I think that it can easily be combined with the relation of fence to economy of equipment operation, as both depend to a large extent on proper field arrangement. In the first place, a properly laid out farm with fields of long rectangular shape and so located as to require a minimum amount of travel to and from the buildings materially reduce the cost of equipment operation. Furthermore, a good system of crop rotation can seldom be practiced efficiently, unless there are the same number of fields as there are years in the crop rotation and the same fields are of approximately equal size. If the fields are not so arranged and laid out, there will be labor peaks varying from year to year which will materially affect the economy of labor and equipment operation.

Fields should be laid out so as to make possible the running of livestock in every field to utilize crop wastes and residues and to allow the animals to feed themselves as much as possible and to minimize the amount of personal attention required in escorting them to and from the fields.

Ninety per cent of our farms at the present time still follow the same or much the same system of field arrangement as they did when three and four horses were the common units of power. Now, we have tractors and larger equipment that require a field arrangement in keeping with the change in conditions. In many cases, it will require less rods of fence to fence a farm properly when it is rearranged than under the existing layout, but I assure you that the fence industry has no desire to encourage old and inefficient layouts in order to sell more rods of fence. For one thing, if a farmer is encouraged to rearrange his farm, he is more likely to fence all of it hogtight, thus requiring a much greater volume of fence than he has formerly used when many field divisions



(Left) Woven wire fence with from one to three barbed strands, typical of the fence being installed by farmers in Iowa, Minnesota and the Dakotas. (Right) A well fenced farm

were unfenced or merely divided with two or three strands of barb wire. Such a system of field arrangement and crop rotation encourages the raising of livestock, whereas our present systems of field arrangement directly discourage it and greatly increase the production cost. Therefore, this question of field arrangement is of vital importance to you as structures men who are interested in designing and extending the use of profitable farm structures. It is to be debated whether the lack of fence is responsible at the present time for the smaller amount of livestock on our Middle Western farms, or whether the lack of livestock has discouraged the use of fences. I am inclined to believe that the former is the case due to the fact that many farms are tenant-operated and the landlord refuses to fence it properly in order that the tenant can raise livestock.

This brings us to the question of land valuation and to the question of the relation of fence to the tenant problem. Livestock farming everywhere is understood to be the best means of conserving soil fertility. The trouble is that many land owners have found it difficult to embody this belief in a practical system of tenant farming. More and more they are turning to the 50-50 livestock lease or some variation of it in spite of its complications and occasional difficulties. This policy is to be commended and what follows is not to be construed as discouraging this system, but is a suggestion whereby landlords may achieve most of the permanent benefits of livestock farming without sharing directly in the investments and problems of animal husbandry.

The absentee-landlord especially is concerned in keeping up the crop-producing capacity of his land, of maintaining its market value, of conserving as much as possible of that plant food which is the soul of the soil. If it can be done by livestock farming, and it can, he cares little who owns the stock. He will gladly forego current profits from the livestock enterprise if he is thereby relieved of risk and responsibility involved and at the same time is assured of its soil-conserving, yield-producing benefits coming to him automatically through the selfish interests of his tenant. Investigation shows that there are plenty of tenants willing and able to carry on their own livestock enterprises without a 50-50 lease or any partnership with the landlords. They are willing to furnish all of their own capital for the foundation stock and take all the hazards of the business. All they need is a farm fitted to the keeping of livestock.

We hear over and over from the tenant the refrain, "I would have more stock if the place had fences to hold it," but the landlord should want fences for the animals not so much to keep them in as to let them out. He is concerned not only with serviceable fence of a type that will hold every sort of stock that it pays him to have in the field, but with the field arrangement that will encourage the tenant to turn it out.

Thinking for a moment of the value to the landlord of a system of farming which increases soil fertility, we may hark back to the Ohio experiments and figure out how much the $10-per-acre increase in crop yields is worth to the landlord. On a cash basis, of course, it means some $5 per acre per year in his cash income, but from the standpoint of selling value of the farm, it means an increased valuation based on earning power of approximately $60. This dramatizes very briefly the vital part which fences play from the landlord's viewpoint, but it is a message which the landlord must be made to understand in contrast with his present attitude toward putting fences and building improvements on his farm.

The question of the relation of fence to increased farm production per acre and per worker hinges very largely on the items discussed above, namely, soil fertility and labor and equipment efficiency. The crop rotation system plays an important part, as it is important to adopt a system of rotation with as many high-profit crops as possible, but still with sufficient crops to furnish roughage and return fertility to the soil. The relation of fence to sales value of the farm as affects mortgage bankers, local banks, insurance companies and individuals has also been covered to some extent, but it is of sufficient importance at the present time to warrant further consideration. Many banks and insurance companies have come to the conclusion that they must supervise the operation of their farms if their investment is to be protected. The growth of privately-owned and managed farm management systems also are an outgrowth of this problem. Almost without exception one of the first things done by these organizations is to rearrange the fields, make a soil survey and start fencing for a livestock program. On the other hand, however, there are thousands and thousands of acres and thousands of farms owned by banks which are being allowed to deteriorate annually in value due to the lack of such improvements, and it is, therefore, a problem of producing data which will show these organizations that additional investment in such items of equipment will be necessary before they can hope to salvage their present equity.

The economic length of life of fence as compared with the actual period of use is a problem which should receive further study. Our surveys show very conclusively that there are millions of rods of fence in existence at the present time which are costing annually more in repairs and labor costs than the annual cost of new fences.

Data should be found which will show the farmer conclusively that he will be much further ahead financially to replace his fences when they reach a stage to require repairs rather than to struggle with them four or five years more, inviting livestock losses and excessive costs.

The use of temporary or portable fences is rapidly increasing throughout every section of the country. The growth of this type of fence has undoubtedly been due to the increased use and development of steel posts which make possible the erection of 80 rods of good fence by one man in less than a day's time. Just as in other farm practices hard work in erecting fences discourages their use and any method of reducing the amount of labor encourages their use. Hence, we find portable fence used very widely for hogging down corn, fencing small grain fields to utilize sweet clover after threshing, the fencing of temporary pastures, pasture rotation and livestock sanitation methods. All of these practices are very profitable and the use of portable fence should be further encouraged in every way possible. This means that a study should be conducted to find the actual earning power of portable fence for various uses. You will notice that I have used the word "portable" rather than "temporary" as I believe that the word "temporary" carries an inference of makeshift methods and discourages to some extent the use of this type of fence by the more thrifty type of farm operator.

It is a sad fact that practically all of the studies on fencing which have ever been made have dealt with the subject of mechanics of fencing, and rather than tending to encourage the economic use of fence have tended to discourage it, due to the fact that ways and means of reducing fence costs have been emphasized rather than means of increasing fence profits. This directly tends to encourage the belief that fences are a necessary expense. Manufacturers have been guilty until recently of promoting this same idea in their advertising by talking about reducing fence costs, but now almost without exception are emphasizing the profits which can be realized from the economic use of fence.

There are problems in mechanics, however, chief among which is the proper installation of corners and brace posts. It is very hard to find a good installation of this type anywhere in the country where one may drive, and consequently we see miles and miles of sagging fence; here and there is a broken post which might easily have been prevented by proper corner construction.

Another study which might well be made due to the tremendous increase in the use of steel posts is to ascertain definitely the relative strength and permanence of a permanent steel post fence as compared with other types of posts. Partly, I think, due to the continual promotion of temporary fence, many farm operators, dealers, extension workers, and others have come to the conclusion that steel posts are not satisfactory for permanent fences. I believe that a study of this problem would reveal that steel posts are as satisfactory as any other type if the fence is properly erected with good braces and corner posts.

This, in a very brief way, is an outline of some of the problems that hinge about the subject of farm fencing. I trust that you will agree with me that the fence problem is one of the most important with which the farmer is confronted from the standpoint of increasing efficiency and profits and, therefore, merits the attention which the importance of the problem deserves. I might have mentioned the question of finding the most economical means of removing hedge fences, of which there are a great amount in a number of our middle western states, but this probably comes more within the scope of the Land Reclamation Division. However, it is something of which you might well be thinking for it affects directly the handling of livestock, efficiency and crop production.

Modern Refrigeration Improves Milk Quality

THE great advance in the last few years in the efficiency of transportation of perishable food products, and in refrigeration, on the farm, in transit, and at market, is one of the most important developments affecting the dairy industry, according to O. E. Reed, chief of the Bureau of Dairy Industry, U. S. Department of Agriculture.

"Fast refrigerator transportation for dairy products especially fluid milk, has increased the radius of the milksheds surrounding our large city markets by hundreds of miles," said Mr. Reed, "and is giving rise to the establishment of dairying and dairy manufacturing in parts of the country where formerly the industry could not exist on any extensive commercial scale. In the days of the horse and wagon the dairymen's market was the local community a few miles away. To-day, milk produced in Illinois, Wisconsin or Virginia may be pasteurized and shipped hundreds of miles and be delivered to consumers as fluid milk in excellent condition.

The transportation of milk and cream long distances under refrigeration is simply an application of the principle which has been working in the fruit and vegetable trade for many years. Florida watermelons are found in the New York markets, and probably California cantaloupes can be found in Florida markets. Pasteurization gives an advantage in the transportation of fluid milk and cream which the fruit and vegetable industries do not enjoy. The possibilities in the long-distance transportation become larger as more efficient, more practical, and cheaper means of refrigeration are developed.

Motor-truck refrigerator transport of milk and cream is having marked effect on the dairy industry in many localities. In more than one formerly isolated dairy community the motor truck is now hauling the milk many miles into the city as fluid milk, leaving the creamery a supply insufficient for profitable operation. There is a general tendency for the fluid-milk business to push the creameries, condenseries, and other dairy-products factories from the immediate milk-sheds of the large cities out into the more remote areas.

Another trend in the dairy industry is the increasing mechanization of the industry. Most of us remember the wooden churn of our boyhood as the symbol of the dairy industry of those days. The wooden churn and its country butter are now scarcely more than memories. Vast changes have come in a few short years. The engineer and his machines have brought us economies and efficiency, greater profits, sanitation and relief from labor.

The most outstanding accomplishments have been in connection with market milk for the fluid-milk markets. Great improvement has been made in the quality of market milk in the last twenty years. This improvement has been due largely to the cooperation of the industry with milk-control authorities. Producers stopped fighting inspection some time ago and began to help promote it.

Although our per capita consumption of dairy products is less than that of some other countries, our trend in consumption is consistently upward. In 1922 our per-capita consumption of milk and cream, in terms of milk, was 50.0 gallons, and four years later it was 55.3 gallons. Per-capita consumption of butter increased from 16.5 pounds to 17.82 pounds, and consumption of cheese increased from 3.70 pounds to 4.36 pounds. In 1922 our consumption of condensed and evaporated milk was 12.69 pounds per capita, and four years later it was 14.32 pounds.

Deep Wells and Pumps for Drainage and Supplemental Irrigation[1]

By E. H. Neal[2]

IN IDAHO, as elsewhere in the irrigated region, the continual application of irrigation water has made necessary the construction of extensive drainage systems to protect irrigated lands upon which from $100 to $300 per acre has been placed in water delivery systems, preparation for irrigation and in improvements. In general this drainage has been attempted by the use of deep open or by closed tile drains. As the years have passed since the early drains were constructed, it has become increasingly apparent that the results have not been as far-reaching as was expected, and that while the rise of ground water in certain sections was checked, the continual application of water to higher areas still over-taxes the natural underground drainage supplemented by the artificial drainage, and more areas are becoming waterlogged each year.

If the excess accumulation of water underneath the valuable farm lands can be removed at a place where it can be utilized for irrigation, rather than being wasted away from the land, true conservation of this most valuable resource (water) can be accomplished. Pumping the excess water to the surface with deep well pumps of large capacity then serves the double purpose of relieving the land of its excess ground water and providing water for irrigation.

Furthermore, the available supply of irrigation water is definitely limited and must be used more efficiently and must serve larger areas if agriculture by irrigation is to be extended. Drainage by artificial channels and by the natural underground means often results in a return flow on the lower reaches of streams that is more than sufficient for the adjacent lands that can be served, while shortage may exist upon the upper reaches of the same stream. Also the very considerable quantities of water discharged by drains and return flow in the non-irrigation season as well as the water stored in the soil below the level of the drains is not utilized for irrigation.

The feasibility of pumping from underground for the dual purpose of effecting drainage and at the same time making the pumped water available for irrigation use, has been well demonstrated by experience in various irrigated areas in California and Arizona where substantial quantities of water are taken from underground each year. In these localities where pumping wells have been in operation for years it has been found that wells from 12 to 18 inches in diameter cased with light steel, which is perforated at the water-bearing strata and sunk to such a depth as to make a connection with the permanent ground water level have a capacity that makes operation economically feasible and are best suited to the pumping equipment available. Where the wells are not sunk considerably below the upper ground water level to a connection with the permanent water-bearing strata, experience has demonstrated that a constant and sufficient source of water supply may be lacking.

In addition to the drainage effect and the recovery of irrigation water, drainage by pumping has the additional advantage of flexibility. Plants can be placed at critical spots in wet areas, can be added to whenever necessary, and a whole system need not be installed at once. The unsightly open drain with its ugly spoil bank, cutting through the farms, and occupying valuable lands and an eyesore to the community is unnecessary.

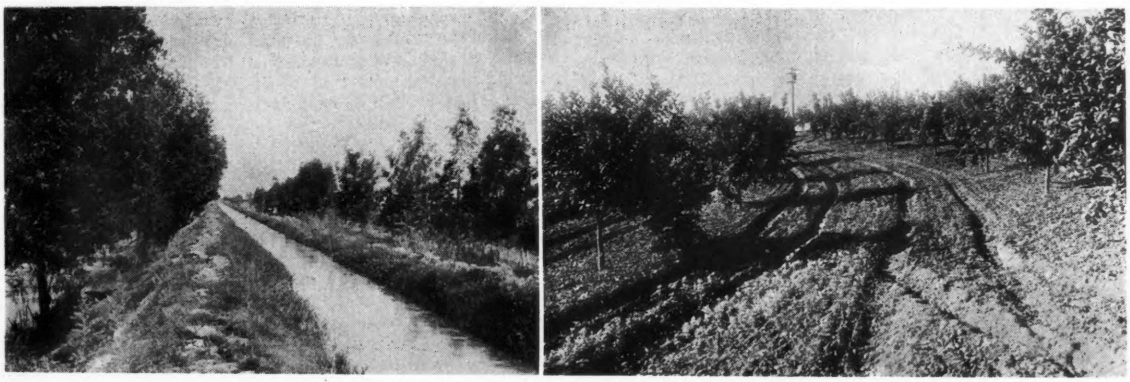
In the Boise valley in southwestern Idaho a pioneer installation of deep well pumps has been studied by the Department of Agricultural Engineering of the University of Idaho in cooperation with the Idaho Committee on the Relation of Electricity to Agriculture. In this study particular attention has been paid to the cost of drainage and to the effectiveness. The group of four wells studied were the first sunk in this section and as a result considerable extra expense was incurred due to the exploratory work necessary. This extra expense will be unnecessary as other plants are added. Furthermore, due to the experimental nature of these installations, the method of development used with one well has not proven satisfactory with the result that the yield is low.

Two of the wells are the gravel wall type 18 inches in diameter and respectively 133 and 100 feet in depth; two others are of the California stove pipe type, one 12 inches in diameter and 146 feet in depth and the other 18 inches in diameter and 132 feet deep.

These studies indicate that the first cost of the plants is from $4000 to $6000, or about $5.00 per acre-foot pro-

[1]Paper presented at a meeting of the Land Reclamation Division of the American Society of Agricultural Engineers, at Kansas City, Mo., December 1929.

[2]Manager, Aberdeen-Springfield Canal Company. Mem. A. S.A.E.



(Left) A small irrigation canal in the Imperial Valley in California. (Right) This picture shows the contour method of orchard irrigation

duced. The cost of operation of properly designed installations runs from 60 to 90 cents an acre-foot. This is with a drawdown of from 35 to 45 feet and a yield of from 3 to 6 cubic feet a second, or from 1300 to 2700 gallons per minute. It should be mentioned that not all the present plants have attained this yield as they have been experimental in character due to the absence of information upon development methods that should be employed. Data upon motor and pump depreciation and repairs is not available, but in any case will not be more than a few cents an acre-foot. A pump similar in construction and an electric motor used for water supply on the University of Idaho campus has run from 12 to 20 hours each day since the spring of 1921 with but one repair, a copper gasket in the thrust bearing being replaced this spring.

In this state exemption from taxes is allowed upon that part of plants and transmission lines of the power companies that are used in the production and transmission of power for irrigation pumping. With this tax exemption discount and the low rate offered for irrigation pumping, the average cost per kilowatt-hour used has been 0.9 cent. To get this lower rate the pumps must be operated continuously from May 15 to October 1. The 12-inch well was drilled as an 18-inch bore without first putting down test holes. As first constructed the depth was 203 feet with the following log: Soil, 0 to 5 feet; clay, 5 to 96 feet; fine sand, 96 to 146 feet; and clay from 146 to 203 feet. The casing later collapsed at the 132-foot level, but was swedged out and 12-inch casing was placed to 146 feet. An attempt was made to gravel wall the well at the same time. The yield from this well has never been satisfactory. The failure of this well to produce water economically illustrates the necessity for careful test hole exploration before drilling of the well itself begins.

The experience gained by the irrigation district with these wells has demonstrated that on account of the extreme variations in the underlying formations, the details of construction of the wells, the diameters and proper depths must be very carefully studied for each individual well, and properly designed pumps and experience and good judgment must always be depended upon to insure successful installations.

As regards the effectiveness of the drainage, the data collected has not been in sufficient detail to justify conclusions or specific recommendations. A series of observation wells were placed on lines at right angles through each of the pumping plants. Upon attempting to work upon the data obtained it has become evident that the ground water levels were not observed often enough and that the observation wells are too few in number for a study to be made of the extent of the drainage affected. However, an examination of the surface indicates that from 700 to 1000 acres around each of the pumps has been effectively drained.

The first cost of a pump drainage system is substantially below the cost of the open drainage system as is often used in this state. The largest difference comes in the cost of the power to operate the pumps. To offset this cost of power for pump operation there is the value for irrigation of the water pumped. The water developed by open drains cannot usually be recovered at a place where it can be applied to the lands from which it is contributed.

The lack of success resulting from drainage by channels and the difficulty of effectively measuring the results of pump drainage is undoubtedly due to the presence of ground water under pressure. Coarse sands and gravel underlie much of the irrigated land. Irrigation upon the higher lands and the resulting deep percolation introduces water to these coarse strata. The soil above these strata offers a frictional resistance to the upward movement depending upon the depth and character of the soil. This serves to partially confine the water and place it under hydrostatic pressure. Due to the lack of uniformity in depth and character of the soil, the wet areas follow no definite rule in occurrence. Under such conditions pumping from wells lowers the water table much further than is possible with open drains even when artesian wells are drilled along the open drain.

In addition to the swamp lands unaffected by the present system of open drains, there is a real need for an additional water supply to supplement the present water rights in late summer and in seasons of drought. As the farmers diversify their crops, more water is needed in late summer and as grazing and erosion upon the watershed serves to deplete the late summer supply of the streams, the need for additional water becomes more evident.

In the areas served by the Boise River it is estimated that from 150,000 to 200,000 acre-feet of water can be obtained each year by pumping from wells with the possibility of pumping additional water in seasons of scarcity. This is water that now flows in the gravity drains and water that returns directly to the river as return flow. Only a part of this water is again diverted and used during the irrigation season and all of it flows unhindered to the ocean during the non-irrigation season. With a carefully planned installation of electrically operated deep well pumps on the lower lands this water could all be reclaimed and used on the adjacent lands, freeing the gravity water now devoted to those lands for use on other lands higher up the river. The ground itself could then serve as a reservoir and would conserve the water until it is withdrawn during the irrigation season,

Comparing the cost of such a development with that for storage water, the average cost of pumping, 75 cents an acre-foot, is 6 per cent interest on $12.50, or 4 per cent interest on $18.75. The capitalized cost of pumping water is then from $17.50 to $23.75 an acre-foot. It is doubtful if additional storage can be obtained at this price as the cost of the storage water in the Arrow Rock reservoir built on the Boise River in 1915 was about $17.50 per acre-foot. Reservoir water at the same price per acre-foot is not comparable with the water pumped at the land for there would be an annual fee for reservoir operation and maintenance and for the supervision of the conveying channels charged against the storage water. This fee would be from 10 to 25 cents per acre-foot. In addition the loss by seepage through the conveying channels would be 5 to 15 per cent. These charges would be in addition to those for distribution and seepage on the project itself. If it were possible to obtain electrical energy at a lower rate from some of the nearby government power plants, the cost of pumping would be further reduced.

Chemical analysis of water pumped from deep wells shows that it contains a lower concentration of alkali salts than does nearby surface drainage water and is not harmful when used for irrigation purposes.

In Idaho under the doctrine of appropriation the legal status of the water developed by pumping is not fully settled. As a means of protecting the right to the use of the water an application for a water right upon each well has been made to the department of reclamation of the state.

An illustration of the confidence shown in pumping from deep wells as a means of obtaining drainage and supplemental irrigation water is shown by a contract recently executed between a drainage district and a canal company in the Boise Valley. By this contract the drainage district guarantees to supply 7000 acre-feet of water each year to the canal company to be paid for at the rate of $1.00 per acre-foot. This drainage district is starting on a pump drainage development under which twenty wells will eventually be installed. This problem of drainage and of full utilization of our limited water supply is of major importance throughout Idaho and the irrigated west.

A House for the Farm Family

By Greta Gray[1]

ALTHOUGH there are exceptions, farm living differs from city living and a suburban house does not, as a rule, meet the housing needs of the farm family.

Farm work and chores begin before breakfast and end after the evening meal instead of being begun and finished between the eight o'clock and the five o'clock whistles. The farmer comes home for dinner in lieu of eating lunch in a cafeteria. He comes from muddy or dusty fields and roads instead of coming from an office or factory via cement sidewalks. The children return from school over the same fields and country roads. Men and children come to meals and spend much of their leisure in the house in rough clothes bringing in more or less dust and dirt. Consequently, the family sitting room cannot be furnished with as delicate furnishings nor kept in as good order as if it were in the city. For this reason the farm wife likes to have a best room not in daily use. The old-fashioned parlor which under modern conditions in the city has developed into the living room still has a place, when it is modernized and furnished in present-day style in the farm home.

In the farm house provision for house guests is needed, since there is no nearby hotel where friends may stay and because visitors are more important to the farm family than to the city family, as farm people have not the opportunities for the daily contacts with their fellows which city people have. On the farm there are not so many visitors coming in for a short visit in the afternoon or in the evening as there are in the city, nor so many other persons who ring the front door bell. The members of the farm family use a back entrance for their rather frequent goings in and out.

On the farm there is more household work which must be done at home than in the city, since a large part of the food is produced on the farm and because the delicatessen, the restaurant and the steam laundry are not near at hand. Besides doing the household work the farm housewife as a rule has poultry and a garden to care for and she may even help with the farm work. Although this outside work is in a way recreational, it is also income-producing and, therefore, it is doubly important that the farm wife have time for it. To save time and labor, the farm house should be arranged to make the doing of the household work as easy as possible.

The farm family is apt to vary more seasonally as to size than does the town family, for children sometimes have to go away from home in order to attend high school. As the farm family varies with the years, little children growing up, boys and girls leaving home temporarily, and finally permanently, the family cannot so readily shift its quarters according to its needs as the city family can.

Because of this it is desirable that the farm house be as flexible as possible, permitting of part of it being shut off from the rest. It is an advantage also to plan any small farm house with a view to adding to it later and to making both the original temporary house and the larger completed one convenient.

The farm house is isolated and therefore it is more important for it than for the suburban house that the construction be fire-resistant, or better, fireproof.

The house illustrated was designed to provide for the specific housing requirements of the farm family. The exterior view suggests the general form, the design of the exterior may, however, be varied considerably. The floor plans are the important drawings for they show the arrangement of rooms and other features.

As may be seen in the first floor plan, the entrance for men and children is a grade entrance in the direct path from the barns. It is not through the kitchen and this is an advantage avoiding confusion just before meal times when the cook is busy with last-minute preparations. There is a coat closet at the left of this entrance, a toilet and lavatory at the right and the door to the dining room which is also the family sitting room is nearly opposite.

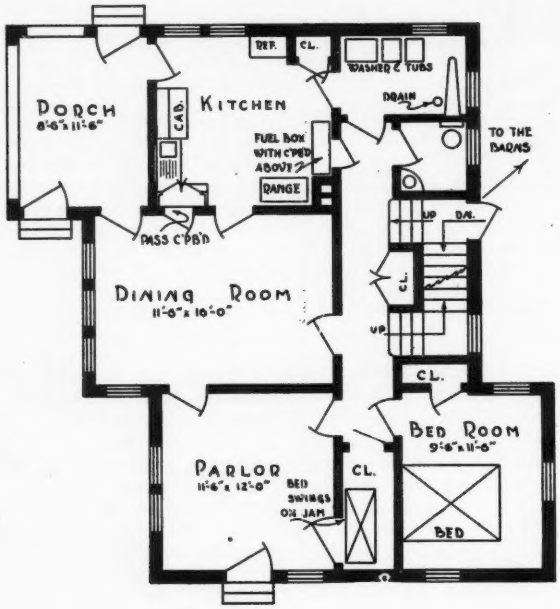
The parlor is smaller than the combination dining and sitting room. There is good inside wall space for a piano in the parlor, and it has a wall bed so it may serve also as guest room or as an extra bedroom in case of illness. The front entrance is directly into this room. In a city home it would be better to have the entrance into a hallway, although this requires more space, but this is not important on the farm, since the front entrance is used so little.

There is a screened living porch opening from the combined dining room and sitting room and from the kitchen. Meals may be served and some of the kitchen work may be done on the porch. Besides the rear entrances and the formal front door, there is still another entrance to the house through the porch and dining room.

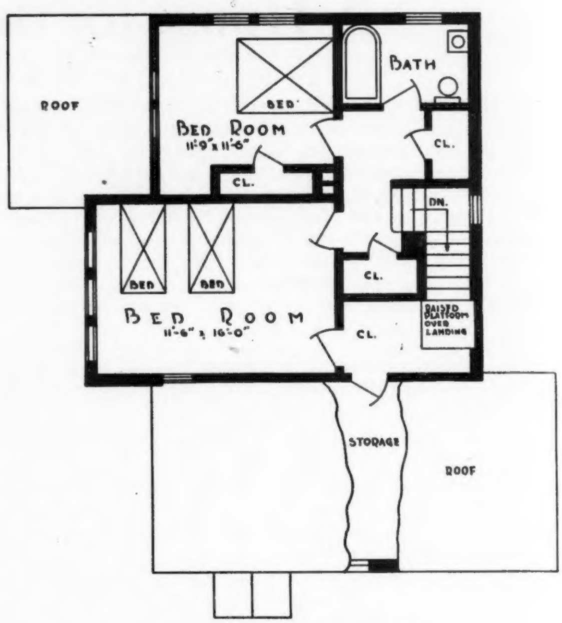
The kitchen is exceptionally well arranged. At the left of the stove is the fuel supply in the lower part of a closet. This fuel supply may be replenished from the hall. fresh supplies being carried up from the basement. The opening from this closet into the hall is almost at the head of the basement stairs. The fuel box might be mounted on a dumb waiter and lowered to the basement for filling. The upper part of the fuel closet may be used for cleaning supplies. Where cobs are used for fuel, the store closet in the kitchen could be made into a fuel

[1]Associate professor of home economics, University of California. Assoc. Mem. A.S.A.E.

(Left) Elevation of farmhouse planned with a view to the future addition of a parlor and downstairs bedroom. (Right) Same house with parlor and bedroom added



First • Floor • Plan



Second • Floor • Plan

Floor plans designed with special consideration for the livingand working conditions of the ordinary farm family. These plans are for the same house shown in the elevations

closet filled from the outside, and the closet near the range used for a store closet for staples. There is space for an oil stove to be set up in front of the fuel closet for summer use. If an electric stove were to be used the year around, it might be placed where the door to the dining room is shown, and this door placed in the inner corner of the kitchen to make the work space more compact. The stove is close to the dining room door, so food ready to be served need not be carried far.

There is, on the other side of the door between kitchen and dining room, a closet opening from the dining room by an ordinary door and from the kitchen over the sink by cupboard doors. Dishes, silver and table linen are kept in this closet. The table may be set without going into the kitchen and the dishes after being washed may be put away without going into the dining room. Soiled dishes from the table may be placed in this closet from the dining room side, then scraped and stacked for washing from the kitchen side. The kitchen cabinet or work table is at the right of the sink and near the stove. Dishes are stacked on the cabinet and drained at the left of the sink and put away in the dish closet adjoining. For right-handed persons, this is the right way for dishwashing to proceed, counter clockwise, for it saves motions and therefore time and fatigue.

The kitchen has a closet for staple supplies and for cooking utensils which are infrequently used and which for this reason are not kept at the sink, work table or stove. There is space for a refrigerator adjoining this closet. If ice is used in the refrigerator, it need not be carried far into the kitchen. The refrigerator may be iced from the outside by building an icing door in the wall behind it.

The kitchen is well lighted and has cross ventilation, and additional ventilation may be secured through the laundry. There is room in it for a chair for a neighbor or for the farmer, and for a play corner for little children. Children may play also on the porch, in the dining room or in the laundry, in each case under the mother's observation as she works in the kitchen. The housewife may go from the kitchen out of doors by way of the grade entrance, but she has also a more direct route through the porch.

A laundry is shown in this plan, small but large enough for a washing machine and tubs on legs provided with casters which, when out of use, may be pushed into the corner leaving room for a folding ironing board and for the folding ironer, if one is used. The kitchen stove is near and with the push-around tubs may be used conveniently for boiling the clothes when that is desired. If the washing is done in an outside wash house this room may still be used for ironing and for a sewing room and for a play room.

The farm wife as a rule likes one downstairs bedroom. There she or the baby can have a quiet nap without stair climbing, or a sick person may be cared for with the least effort. This house has a downstairs bedroom and closet near the living and work quarters yet separated from them by a hall, so it will be quiet. Upstairs are two bedrooms each with a closet; a bathroom, a closet for linen and a closet for cleaning supplies. There is also storage space which might with a different exterior be made an additional bedroom or two bedrooms. Three bedrooms are enough for most families, one for the parents, one for the daughters and one for the sons.

The three bedrooms in this house, and the parlor which may serve as a fourth bedroom, have cross ventilation and are entered from a hall, as are the bathroom and the downstairs toilet and lavatory. There is a minimum of hall and stair space, yet privacy and convenience are well served. The stairway to the second floor leads up from the hall and the door to the downstairs bedroom is just at its foot. The stairway leads into the second floor hall and the bathroom is almost at its head. This arrangement is desirable since occupants of the first floor bedroom must use the bath tub on the second floor.

The combined dining room and sitting room, the kitchen, the laundry and the second floor of this house

may be built first, and later the parlor and the downstairs bedroom may be added with a minimum of tearing out of old work. The rooms in the extension shown in the accompanying drawing may be easily shut off from the rest of the house when they are not needed, in order to save fuel and cleaning.

There are a few other miscellaneous points of convenience and economy about this plan. If water is heated by the range, the hot water storage boiler may be placed in the upper part of the fuel closet, in the closet of the back bedroom, or by shifting the plumbing fixtures a little, in the bathroom. In any one of these places it will not become covered with dirt and grease as it would in the kitchen. If placed in the upper part of the fuel closet, part of the remaining space in this closet might be used for drying out wet boots and wraps, since it would be heated by the flue and by the boiler. It the boiler is placed in the bathroom, it will help to heat this room. The front part of the house plan may be altered without making any change in the work areas or hallways, that is, the dining room, parlor and downstairs bedroom; one or all or any two of them may be enlarged or made smaller without necessitating changes in the rest of the first floor plan. The stair to the basement is directly under the stair to the second floor, and it is conveniently reached from either the kitchen, the sitting room or the bedrooms. The lavatory and the laundry on the first floor and the bathroom on the second may be served by the same plumbing stack.

Although the requirements for comfort and convenience in city, village and farm houses are the same in regard to many items, there are others in regard to which they differ greatly. Because of these differences the small house plan well adapted to suburban ways of living does not meet those of the farm. The opposite also is true. The plan given here was developed to satisfy the specific housing requirements for comfortable farm living. It is not the only satisfactory plan for a farm house. Others have been and may be worked out to provide arrangements as adequate, convenient and pleasing as these. The point essential to success in planning farm houses is to keep in mind farm ways of living.

How the Engineer Can Help the Farmer Build Good Farm Buildings[1]

By Henry Giese[2]

THE farm building problem is fast coming into its own as one of the major factors incident to successful farming. When one considers that the national investment is nearly 12 billion dollars and that the investment in the states represented in our North Central Section is approximately 3¼ billions, it is at once evident that this is one of the largest single items with which farmers have to deal. Due to the severity of our climate, housing becomes a necessity and the question is not shall we build farm buildings but rather how shall we build them in order to secure the greatest possible returns from the investment.

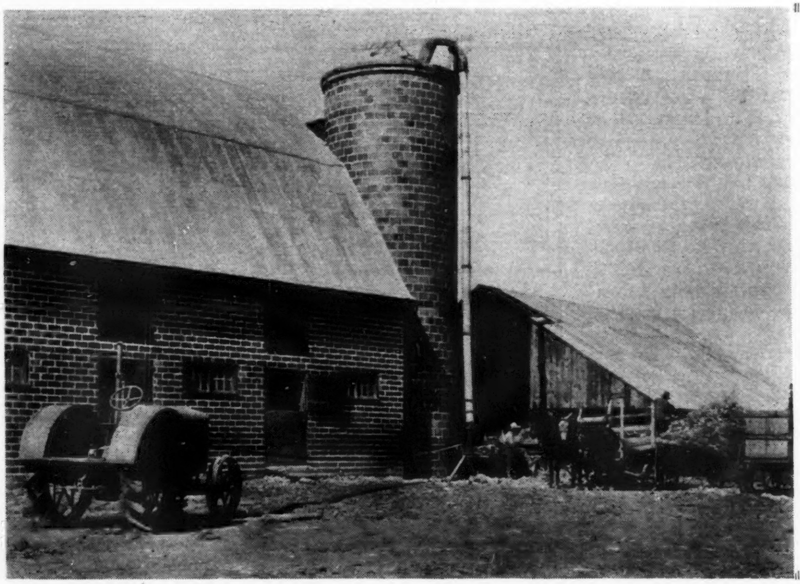
[1]Paper presented at a meeting of the North Central Section of the American Society of Agricultural Engineers, at Fargo, N. D., May, 1929.

[2]Assistant agricultural engineer, Iowa Agricultural Experiment Station. Mem. A.S.A.E.

Years of effort have resulted in developing livestock into high production units which are unable to cope with the seasonal fluctuations and still produce economically. Maintenance of health and vitality depends very largely upon the manner of housing. Feed is a high-priced fuel and a poor substitute for a good building. The cost of management or husbandry is influenced by the amount of care and effort spent in properly planning and arranging the buildings.

The proper housing of crops is likewise dependent upon the building program and it may determine the success or failure of the farm enterprise.

Some crops must be cured for market; others stored for better prices or awaiting home consumption. Housing makes possible the holding of perishable produce to secure a longer marketing period and a better price for



Agricultural engineers are in a position to render the agricultural industry an invaluable service in the design and development of farm buildings. Without the right kind of engineering guidance, a building may become a liability to the farmer, but correctly designed and planned for best efficiency, it can be made a distinct asset. The farm building problem, if it needs anything at all, needs intelligent engineering direction for proper solution

the grower. Grains in particular need to be kept away from rodents which consume large quantities and render more unfit for use.

With all its importance, this problem has not been adequately handled. There is a lack of specific and accurate information. Much of what has been accepted is traditional and without scientific foundation. Differences of opinion and lack of cooperation between states tend toward confusion and ineffectiveness. The architectural profession generally has been disinterested in the problem due to the scattered field and the small construction units. In fact the farmer has not been sold on hiring professional assistance and has not approached the architect or engineer.

This situation constitutes a direct challenge to the American Society of Agricultural Engineers and particularly to those of us living within the section where farming is a major enterprise. It is up to us to revise our codes so that we have at our disposal more reliable information. It is then just as essential that we develop our means of dissemination so that we may put this before the people in need of it. The trend of interest in our own state of Iowa is shown in that the call for building plans last year was six times that of two years previous.

The successful conduct of an enterprise of this kind requires a united effort. At a meeting in Chicago last December the Structures Division of the Society took definite steps in this direction. These will fall by the wayside unless enthusiastically supported.

The first of these was in regard to a national survey and coordination of farm structures research. Resolutions were adopted asking the Honorable the Secretary of the United States Department of Agriculture to make a survey of the research projects now under way in the various institutions, the facilities available for the conduct of research, and projects needing further investigation. It was also asked that the Department formulate a national program and stimulate and coordinate the work of the various institutions and agencies.

Realizing, however, that getting fundamental information by this method must necessarily be slow, it was also decided to use other methods of assembling information which would provide tentative standards pending exhaustive research. With this in mind a questionnaire was developed by members of the Structures Division and sent to successful dairymen. Several thousand were circulated and some have already been returned. This questionnaire contained forty-five major questions covering the housing requirements for the dairy cow. If successful, this will doubtless be followed by other efforts to standardize our information relating to farm structures and compile it into a handbook which will represent the Society's effort and be accepted as authoritative.

Another item of considerable interest to the structures men is the plan service offered to farmers. Requests come in increasing numbers for building plans suitable for various farming buildings. If the farmer desires help in planning his buildings, he very naturally turns to his state college for it. In this way we have not only an opportunity to influence farm architecture but also a definite responsibility in seeing that it is properly handled. Most of the states have felt this responsibility and have developed building plans. Perhaps in most cases, like our own, the first step was to render individual service. It was soon found that the demand was so great that to continue making individual plans was impossible. From those already made, certain more representative plans were selected and advertised as an available list. That this was a good move and a real benefit to the farmer can not be denied. At the same time, it does not take a very close scrutiny to show that there has been much duplication of effort and differences in recommendation from state to state. The U. S. Department of Agriculture has compiled a list of plans available from the various stations. In this we find a large number of plans for each of the various farm buildings.

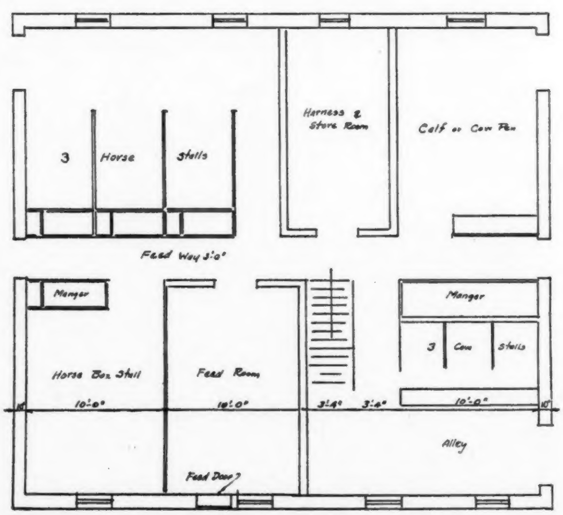
We have in our own country relatively few climatic belts. Is it not logical that, for example, dairy barn design should follow climatic belts rather than state lines? Does it require a different arrangement of stalls, feed rooms, etc., for efficiency of management for Minnesota or Iowa? In the interest of simplified practice, to reduce the confusion which must result when one notes the differences in recommendations from various stations, wouldn't it be a real step forward if we were to cooperate and build a real plan service, national in scope and unquestioned in quality? A program of this kind would require a larger number of plans than any one state would use. I do not want to be understood to suggest that we should advise the building of exactly the same barn for every section of the country. What I do have in mind is that we forget personal differences and the idea that we must have something which is distinctly Iowa, Minnesota, or Dakota, but pool our interests and resources, eliminate useless duplication of effort and build a real cooperative plan service.

How can this be done? First let us as a section where farming interests do not differ widely nor climate fluctuate greatly, get together in a conference at a convenient place. Let us then consider (1) what plans should be made available for rural construction in our section, (2) what plans we have in our files which meet the situation perfectly, (3) what alterations or additions should be made to make each plan most effective, and (4) what the most effective means is of getting these plans to the man who expects to build.

This much, perhaps, can be accomplished in conference. The responsibility for carrying out the suggestions of the conference can be assumed individually and further negotiations carried on by correspondence.

We in Iowa feel that, while our plan service has served a real need in the past, it should be completely revised to take care of the present and future. We would like to do this in cooperation with others and feel that the public would very greatly benefit thereby.

In closing then, there is a real farm building problem. Farmers must build buildings for livestock and crops. Whether these constitute an asset or a liability depends to a large extent upon the agricultural engineer.



A barn floor plan prepared for study and criticism by college farm structures students

Soil Conservation as an Aid to Flood Control[1]

By W. H. McPheeters[2]

DURING the past few years in Oklahoma, as in many other states, more crops have been destroyed by floods than in former years when the country was new. The remedy for this is what we are seeking.

Almost every conceivable method of saving soil and stopping gullies has been tried out, but the only satisfactory method found so far is that of terracing. In mountainous and hilly sections of the old countries where farms are small the bench terrace is common, but in the United States where the farms are large and the land is rolling, the broad base or Mangum terrace is being used. The narrow-ridge terrace has been used a great deal in the southeastern part of the United States, but it is giving way to the broad base terrace, because the narrow ridge terrace is not cultivated and consequently a part of the field is allowed to grow up in weeds instead of producing crops. Terracing, as a means of saving soil, is not an experiment. It works and must be used.

The wise farmer will go a step further than to terrace. He will contour the terraced fields, i.e., he will plant his crops so that the rows go with the terraces; then each row really becomes a small terrace. This causes the water to soak in more evenly over the field and consequently more of it will soak in. By contour farming the terraced field still less soil and less water will reach the streams thereby further reducing floods. A great deal of complaint is made about cultivating point rows. Several farmers in the southwestern part of Oklahoma have actually given contour farming a fair trial and say it pays, and they use two-row cultivators. They say the small amount of crops trampled down by turning is far overbalanced by increased production due to contour cropping. They also say the time required to cultivate the entire field is about the same regardless of whether the rows are straight or follow the direction of the terraces.

It is a difficult problem to get a custom changed. The average American farmer thinks that rows should be straight because his father and grandfather farmed that way. He also seems to believe that it would be impossible to use modern machinery in cultivating point rows in the middle of the field. Many of them even think that the terrace ridges are handicaps to modern methods of farming and they are, to some extent. However, the man farming rolling land who will not get in line with the soil conservation program, is going to find himself getting poorer each year. He will finally change but not until his neighbor, who has seen the light, has actually proved to him that it pays in dollars and cents to conserve the soil.

The keeping of more water on the field by terracing and contour farming will not stop our flood menace altogether, but it will help. The great floods on the Mississippi River and its tributaries are due largely to the sediment that has been deposited in the river beds for years back. The bottom of the lower Mississippi River has been raised above ground level by depositing sediment from all the states through which its tributaries run. Every foot of soil deposited in the lower Mississippi River bed causes it to have that much less fall, and the velocity of the water is checked, and hence the amount of water which the channel will carry, and the rate of depositing sediment increases. About all that can be done under present conditions is to keep raising the levees and let the river keep building higher with the soil that is being carried to it from a large section of the United States. If we would keep our soil on the fields by terracing, it would be possible to dredge the Mississippi and keep it in shape to carry the water. By terracing and ponding we could also keep part of the water on the land thus reducing the burden of this great river.

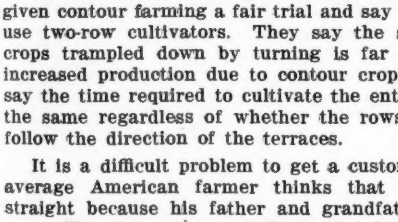
Along with any land reclamation program should go a farm pond building program. It is not possible for every farm to have a pond, but a large percentage of them can. The topography of most of the United States is such that there are thousands upon thousands of natural pond sites, many of them where comparatively large ponds can be constructed at very little cost. Taking the country as a whole, I believe it would be possible to impound an average of one acre of water three feet deep for each farm. This would be equivalent to a lake of several thousands acres in each county. These ponds would keep an immense quantity of water from reaching the streams that now flood the bottom lands and destroy millions of dollars worth of crops and property each year.

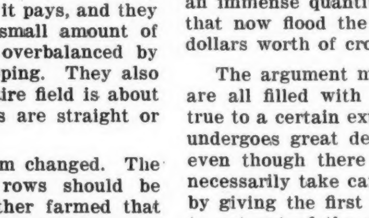
The argument may be advanced that after these ponds are all filled with water they will do no good. This is true to a certain extent, but this vast area of shallow water undergoes great deal of seepage and evaporation, so that even though there is a lot of water in the pond it will necessarily take care of some water from each rain, thereby giving the first water that does reach the stream time to get out of the way by the time all ponds are full. It would also be possible to regulate by law that all ponds be lowered a certain depth in spring and fall after each rain. Many ponds are built voluntarily by a farmer for his own use, but so few comparatively to what ought to be built that they are almost a negligible quantity. With a little inducement by state and federal governments, a real pond program could be developed and water held back from the streams at less cost per acre-foot of water than by any method I know of. The farmer getting the pond for his own use will construct a pond under federal or state supervision at a very low cost.

There are advantages of having a pond on every farm possible rather than a few large reservoirs on the large streams. It is very probable that in the end many large reservoirs will also have to be built to eliminate floods completely. Every farmer that can have a good pond or reservoir on his farm has a storage of water for stock, and he can irrigate a small patch where he can have his own

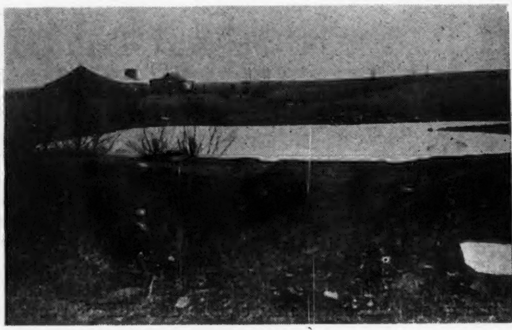
[1]Paper (abridged) presented before the National Drainage, Conservation and Flood Control Congress, St. Louis, Missouri, February, 1930.

[2]Field agricultural engineer, Portland Cement Association. Mem. A.S.A.E.





(Extreme left) Concrete baffle in ditch. (Left) Concrete drop from terrace to road ditch



(Left) A farm pond. (Right) Contour farming. Cowpeas growing on terraced land, Guthrie Soil Erosion Experimental Farm

vegetables and fruit each year in spite of dry weather. He can have fish to eat. He also has a place for recreation in the way of fishing, swimming and boating. All of these are worth while. Farming cannot be considered prosperous unless the people on the farms are content to stay there.

I was asked to discuss soil-saving dams. The type of dam that comes to the average mind when soil-saving dams are mentioned is an earth dam with a large pipe extending underneath it with a joint projecting up in the pond formed above the dam. The soil settles out of the water in the still water above the dam and the water flows away through the pipe. This pipe must be large enough to carry all the water or else the dam may go out. After the soil fills up to the top of the pipe, another joint is supposed to be added and so on until the area is filled with soil. In Oklahoma this type of dam is scarce and I don't believe it is used very extensively anywhere due to the cost of construction.

For gullies too large for the baffle or retarder, an earth dam could be constructed with a masonry spill or drop. This can be constructed with less cost than putting in a large expensive pipe underneath the dam. This, of course, depends on the local conditions. Another way of handling large gullies is with brush or straw dams. After the gully is filled, if it is to be a permanent water carrier, then masonry baffles or retarders, of the proper size, can be built at much lower cost.

Large gullies in the fields should be filled by some sort of soil-saving dams, depending on local conditions. By so doing, just that amount of sediment is kept out of the creeks and rivers thereby giving the water in the stream a better chance to flow. When too much water gets to the creeks and rivers at one time and cannot get away fast enough, they are bound to overflow. In addition to the large ditches already formed in the fields there will be thousands of big ditches formed where they are made along the edge of the field to carry terrace water and the soil out of all these ditches and the road ditches is sure to find its way to the creeks and rivers if it is not held in place. And at the rate terracing is going to increase, these ditches are going to form rapidly if they are not protected.

We will probably not get any more soil to the stream than we are getting now with fields unterraced, but the chances are it will get there a little faster because a lot of water in one channel will carry more soil than if divided up into a number of channels as it now is in the fields. With one ditch carrying the water that has been taken care of by the various gullies in a field, it is an easy matter for any one to see what will happen to this one ditch. The same is true with terrace water emptied into a road ditch. Both the hillside ditch and road ditch can be protected easily and cheaply in the beginning compared to what they can a few years later, and all the soil kept out of the streams. The ditches that will be formed by the terrace should and ought to be protected or else our flood conditions will get worse rather than better.

Before discussing how to control water in ditches by baffles or retarders, I want to say a few words about terrace outlets. There are three possible places to empty terrace water. First, it may be directed into a pasture or into a rocky or wooded piece of waste land. If terrace water is emptied into a pasture, the top terrace should be carried a considerable distance into the pasture, the next terrace not quite so far, and so on, thus distributing the water over the pasture. If the pasture is not well sodded, a ditch will start from the end of each terrace directly down the hill. So if the piece of land is not to be sodded it would probably be better to empty the terraces into one ditch line and protect it with a series of baffles to be discussed further on in this paper.

The next best place to empty terrace water is in a ditch along the edge of the field. It may be along ones own fence line or on a fence line between two farms. This ditch should be protected by a series of baffles built at the time the field is terraced.

The third place is in the public road ditch. Terrace water should never be emptied directly into the road ditch if there is any other outlet for it. If the road ditch is the only possible place then it is advisable for the farmer to get in touch with the county or state highway officials, whichever the case may be, and work out cooperative plans of taking care of this water. For if this is not done, the farmer will probably have to construct a ditch on his side of the fence to carry the terrace water, and the road ditch will be on the other side of the fence with unsightly weeds and caving banks between. Finally these ditches will unite forming a gorge, if both are not protected. By cooperation of farmer and road official the water can be handled in one ditch cheaper and better from all viewpoints. I feel that if farmer and road officials all begin to realize this problem is a serious one and think together, a real cooperative plan will be worked out and a lot of trouble and grief saved.

There is much to be learned about ditch control. However, the best method we know of now is by a series of nearly level benches or steps, each bench being held by a baffle or retarder. One driving along the roads will notice all types of baffles being tried out, most of them having some faults. However, it indicates that thought is being given to the subject.

I wish to mention a few of the most serious faults as I see them. One is that the throat or water gap is too small; consequently water washes around the end of the baffle. Do not guess at the size of the water gap. This should be determined from the area of the land that is to drain through this water gap. At present the tables used in the state highway work on culverts can be used here with safety. Another fault is that on the lower side of the baffle, there are no abutments or side-wall pro-

tection; consequently the water falling over the baffle has a churning effect and tends to eat the banks away on the lower side leaving the baffle with nothing to hold it in place. Still another fault is that there is not sufficient apron at the bottom on the lower side on which the water falls. As a result a large hole is formed on the lower side of the baffle, thus undermining it. There are other minor faults but these are the three most common.

* * * * *

If all the land in this country were terraced that needs to be terraced, and the ditches were all protected that should be and there was an average of a one-acre pond on every farm, we would not have the immense floods we now have. We would have better crops, fewer hot winds, a more uniform rainfall, more springs and spring-fed streams, a more contented people on the farm, and, in general, a more prosperous agriculture. And after all this is done we will know about how much water we will have to make storage for in large reservoirs to completely do away with floods, both on the small and large rivers in the United States.

Engineering Research Applied to Agriculture[1]

Dr. A. F. Woods[2]

THE engineering viewpoint on any subject may be described in a word as the comprehensive viewpoint. The engineering objective is the completed working mechanism whether it is a machine, a bridge, a sky scraper, a manufacturing plant, a business, or a community. If the mechanisn does not work efficiently or effectively, the engineer asks why and proceeds to find and correct the difficulty. It is evident, therefore, that in a highly complex society, where interrelations are numerous and correlations increasingly necessary, the engineering point of view becomes increasingly necessary.

In industry in the past decade this has brought about transformations so rapidly in the direction of waste prevention that it has not only transformed our industrial world but it is transforming the whole world.

The larger and more efficient use of power is lifting the burdens from the backs of toiling humanity and the horse and is enabling the worker not only to have leisure but also to have the means of enjoying it. In this the horse is finding a place, also freed from crushing burdens, and with more leisure to roam in green pastures.

This is quite as true on the farm as in the city. Improved agricultural machinery has had much to do with lifting the crushing burdens of the farmer and his horse and is perhaps the principal factor in making American agriculture the most efficient in the world from the standpoint of production per man.

But agriculture is the most complex and difficult business in the world. It has more variables, difficult or impossible, to control than any other business.

While in comparison with European countries the use of machines and power in the United States is much greater, we have by no means exhausted the possibilities for improvement in this direction. Witness the recent developments in wheat harvesting, the improvements that have been made in corn harvesters in order to control the corn borer, and in plows and methods of plowing with the same end in view.

Incidentally, it has been found that other diseases like wheat, oat, and barley scab, are controlled by the same process of thoroughly plowing under all surface organic matter, including plant wastes. The soil is kept in better tilth by this process and better yields are secured. So it pays in every way.

Now we have found in the research laboratories that corn stalks, straw, oat hulls, cotton-seed hulls, bagasse, and other waste products can be converted into valuable by-products. In the practical application of the research results engineering research and planning is essential to success. The adaptation of machinery for the economical harvesting and mechanical treatment of these wastes is one line of attack. Another is a change in the harvesting methods with the utilization of these wastes in view. Then there are a host of technical processes which require the study of the mechanical and chemical engineer. The processes must be worked out to a point where commercial practicability can be shown in order to bring about proper utilization. At the moment this is one of the most promising fields of development.

Another closely related field is to extend commercial uses of agricultural products so as to utilize low grades or surpluses. For example, our research chemists found a mold that ferments glucose into gluconic acid, which apparently has important uses in nutrition. The lime salt of gluconic acid, calcium gluconate, is the most available salt of lime in human and animal nutrition and the only one that can be absorbed directly by the blood.

The manufacture of gluconic acid compounds is already assuming important commercial significance. This will use a considerable quantity of corn for a new purpose.

Other valuable products may be produced by similar processes from corn and other agricultural products. The field has hardly been scratched. Here the engineer will work with the biologist and the research chemist. Much hope for better utilization lies in this field.

The general recognition of the enormous losses due to slow as well as rapid erosion calls for careful engineering study. Preliminary studies indicate that loss of top soils and fertility by erosion exceeds the losses due to all other causes combined, including fertility removed in crops. The filling of streams and water courses sets up another secondary chain of losses due to impaired drainage, water flow, and floods that result in enormous losses.

Methods of economical control of drainage must be worked out so as to avoid these losses.

In other areas irrigation methods must be improved. Construction of farm buildings, using in part materials made from agricultural wastes and with a view to increasing protection from fire and wind; the development of more practical sewage disposal for rural homes and communities; better lighting and ventilation and heating methods for the farm home; better facilities and methods of cleaning, drying, and storing grain, vegetables, and fruit—all need study from the engineering standpoint.

These are only a few of the well-recognized problems that need attention. Recognizing this great field that has been more or less neglected by the land-grant colleges, the Association of Land Grant Colleges and Universities have backed legislation for rounding out the land-grant college plan by providing for engineering research in close association with the agricultural experiment stations. The problems are closely related with those of the agricultural experiment stations.

I congratulate your society on its constructive and cooperative attitude on all these questions. I can assure you of the hearty sympathy and cooperation of the United States Department of Agriculture.

[1]Paper presented at the 24th annual meeting of the American Society of Agricultural Engineers at Moline, Illinois, June, 1930.

[2]Director of scientific work, U. S. Department of Agriculture.

Report of the Joint Committee on European Corn Borer[1]

THE natural spread and increase of the European corn borer which might be anticipated in a normal season did not materialize in 1930. An abnormally small spread to new territory has occurred this season and in general there has been a decrease in borer population in the older infested regions of the one-brood area, although in Indiana and New York there has been an appreciable increase. This situation has resulted from decidely abnormal weather conditions, beginning when the moths first emerged, which checked flight and egg-laying. Later, seasonal conditions were responsible for a marked decrease below normal larval survival. In spite of the temporary check which has operated against the corn borer, there are a larger number of corn fields carrying a more uniform residual infestation, which forecasts a potentially serious increase and spread in 1931 if weather conditions are favorable.

The present infested area includes all of the corn-growing areas in Canada, excepting the western provinces; also 215,000 square miles in the United States, including the southern two-thirds of New England, northern extremity of New Jersey, all of New York, three-fourths of Pennsylvania, the panhandle of West Virginia, practically all of Ohio, northeastern third of Indiana and nearly all of the agricultural portion of Michigan. In the area east of the Connecticut River in Connecticut, Massachusetts and states north, and that territory in Connecticut west of the river adjacent to Long Island Sound the two-brooded form occurs, while in all other sections of the United States and all infested areas in Canada, excepting Nova Scotia and New Brunswick, only the one-brooded form occurs.

The fact that there has not been a normal increase and spread the past season emphasizes that we may anticipate seasons of increase and decrease in borer abundance as is true of other crop pests and that a temporary check such as the corn borer received in 1930 does not minimize the potential seriousness of this insect as a destructive agency. The Joint Committee, therefore, reiterates a statement made in its report a year ago, as follows:

"It, therefore, is still the opinion of the Joint Committee that, unless the corn borer is controlled, it will become one of the most destructive crop pests ever introduced into America. The situation, presenting as it does, the possibility of enormous agricultural losses, calls for the continued cooperation of the farmer, the scientist, the educator and all state and federal administrative officials."

The committee of entomologists, agronomists, agricultural engineers, agricultural economists and animal husbandmen commends the efforts of all farmers practicing recommended control measures and those engaged in the research, regulatory and educational activities.

The committee recognizes the necessity for the continued development of the research, educational and quarantine programs of the state and federal governments and earnestly recommends the appropriation of the funds needed to maintain and, if necessary, to expand them as suggested later in this report.

After careful investigation of the regulatory, research, and educational activities, the committee suggests and recommends:

1. Since the enforcement of quarantine regulations in the United States has undoubtedly been instrumental in preventing long distance spread of the insect in the past, that this activity of the federal governments of the United States and Canada, as well as the state and provincial governments, be supported and encouraged by all agencies and individuals interested in the welfare of American agriculture. These activities should include, (a) thorough scouting, (b) careful clean-up of isolated infested areas and (c) maintenance of quarantines.
2. That the extension agencies of the federal governments of the United States and Canada and of the state and provincial agricultural colleges, strengthen and coordinate their programs of education relating to the corn borer, extending these to conform with the spread and abundance of the insect and with the increased knowledge gained through research.
3. The entomological investigations now in progress should be continued and the following studies should be stressed because of their particular importance: (a) The expedition of parasite introductions and the development of artificial media for mass production of parasites, (b) the development of effective insecticides and their efficient application, and (c) evaluation of the effect of environmental factors on the insect's activity.
4. While the development of immune varieties seems unlikely at this time, experiments point clearly to the probable development by breeding of high yielding resistant and tolerant varieties of corn which should be an important factor in control. To promote the development of such varieties, the corn breeding programs of the state and federal governments should be continued and strengthened.
5. It is recommended that research with farm implements be continued by the individual state experiment stations as well as by the federal departments of agriculture, and that such research be well supported. Investigations should include the further development of plows and plow attachments and attachments which can be applied to equipment already on the farm; also a further study of pickers with stalk handling attachments, rakes and other stalk handling equipment. The valuable assistance and cooperation given by manufacturers of farm equipment is highly commended.
6. Since the corn borer control practices developed and proposed may change the organization and income of the farm it is important that the relation of these practices to the entire farm business be determined and recommendations made for specific conditions. Proposals including changes in cropping systems, complete utilization of corn, substitute crops, changes in corn acreages, and labor and equipment costs should be worked out in line with the objective of maximum returns from farming.
7. Continued and further studies should be made on the influence of different degrees of corn-borer abundance upon: (a) feeding value of corn and the corn plant in different forms, (b) upon the yield of feed nutrients per acre, (c) comparative feeding value due to different methods of harvesting and preparing crop, (d) use and feeding value of substitute crops and (e) the influence of the corn borer and resultant control measures upon the cost of production and the quality of livestock products.

[1]Membership of the Joint Committee is made up of four to six representatives from each of the following organizations: American Association of Economic Entomologists, American Society of Agronomy, American Farm Economic Association, American Society of Animal Production, and the American Society of Agricultural Engineers. The report is as of September 23, 1930.

Industrial Uses for Agricultural Raw Materials

By Rudolf A. Clemen[2]

THE possibilities of developing new markets for products of American farms can be discussed either from a short or a long-time point of view. Before an audience of engineers it would seem appropriate, as well as profitable, to take the latter method of presentation.

If the business of agriculture had not been changing in organization and methods somewhat as has industry in recent years, we should not be able to attack with success this problem of developing new uses for farm products. But, fortunately, agriculture and manufacturing industry have become more and more alike, from an administrative point of view, and are now businesses which can be carried on by the same general principles.

Ours is a time of swift movement. We are the heirs of three industrial revolutions—the early industrial revolution itself, the electrical and the chemical revolutions—and their influence has speeded up all of us. The steam engine and the industrial revolution made possible mass production. This was hastened further by the electrical revolution with its amazing effects on our national life. The older revolution had promoted concentration of huge plants and cities, had sharpened the line between city and country, between manufacturing industry and agriculture, and had marred the landscape everywhere.

The electrical revolution and its novel motive forces began to rearrange the American social pattern that had apparently crystallized around steam economy. Almost immediately these new inventions began to break down the barriers erected between city and country by the steam engine, checking the rate of concentration in the great municipalities and strengthening the economy of the small town. By carrying into the family circle labor-saving machines, "canned" information, standardized mental excitements, they invaded every relation of life, business and society, and spread urban standards, values and types of conduct over the whole nation. "The influence of the new motors was as subtle as the electricity that turned the wheel, lighted the film, and carried the song."

AGRICULTURE TO BENEFIT FROM DECENTRALIZED INDUSTRY

To carry this thought of decentralization further, there are definite technical and economic forces bringing decentralization of American industry, which may correct most of the evils of centralization and congestion. American industry can be expected to cease the complete manufacture and assembly of all the parts of a machine in one plant, using instead factories located at the source of the raw materials employed in their manufacture.

For a time great industrial centers may persist as points at which the parts, manufactured elsewhere, are assembled and from which they are shipped to local markets. Ultimately the great congested industrial centers will disappear even as points of assembly, for in the end parts will be shipped to the local markets for assembly. This revolutionary industrial change and the equally revolutionary social effects that will follow will come, not because of any Utopian reformer's crusade, but as the result of technical progress in the field of superpower.

The critics of our machine civilization have assumed that we could not have mass production without centralization, but now the outlook is that we shall ultimately find it possible to carry on mass production more profitably in a decentralized than in a centralized industry. Indeed, in such a decentralized situation the national market for products of agriculture, as well as of industry, will be more easily and cheaply covered, and new products can more widely and quickly become known and used.

Following on the electrical revolution is coming quickly the next revolution in industry, the first signs of which we are seeing already. While the older industrial revolution started with a teakettle, and the electrical with a Leyden jar, the new revolution is starting with a test tube. It is a chemical revolution, a revolution in materials and processes which was greatly accelerated by the World War. Out of the problems and experiences of that struggle there developed a number of chemical discoveries which, taken together, may be said to be the beginning of a new revolution in industry.

It is well under way, but we are so close to it that unless we look carefully we cannot see it. The future influence of the chemical laboratory on industry and agriculture can be appreciated by noting that chemistry deals primarily with raw materials and that the per capita consumption of raw material has increased ninefold since 1800.

CHEMISTRY OPENS NEW MARKETS FOR FARM RAW MATERIALS

Both this industrial decentralization and the chemical revolution may go far toward meeting the difficulties that vex the American farmer. The agricultural regions of the United States are the sources of many industrial raw materials. And every year the industrial chemist is finding new industrial uses for the waste products and main products of American farms.

The phrase "farm and factory must prosper together" has become a slogan. If technical developments in power production and transmission make it possible, not only for farm and factory to prosper together, but for farm and factory to produce together in the same neighborhoods, it may prove possible to absorb in such factories the present seasonal idleness of farm labor to an extent that will put a sound economic foundation under agricultural regions without the succor of government subsidy. There are a thousand and one difficulties in the way of any such development, but many far-sighted business men think it promising enough to justify careful thought and detailed investigation.

This chemical revolution is bringing forcibly before each business man, be he in agriculture or industry, a universal question, "Can I stay in business?" Every phase of modern life has been speeded up and changes are more rapid and unexpected than ever. To the manufacturer this question has come earlier, perhaps, than to the agriculturalist. The answer which the wise manufacturer and agriculturist make to this question is, "I can, by the help of technical and economic research."

Like any other industrial problem, the farm problem requires the application of scientific knowledge in the elimination of waste and in the utilization of every shred of usable material. The future betterment of the farmer is largely dependent upon the amount of research that is done with a view to increased utilization of farm products. It is likewise dependent upon the readiness and ability of farmers themselves to adopt and apply scientific methods.

[1]Address before the 24th annual meeting of the American Society of Agricultural Engineers at Moline, Ill., June, 1930.

[2]Formerly associate director, livestock bureau, Armour & Company.

Everywhere in American industries efforts are being made to eliminate wastes. For years American Engineering Council has maintained a committee on elimination of waste in industry, analyzing the source and causes of waste and making concrete recommendations for its elimination from representative manufacturing enterprises. Similarly in agriculture an attempt is being made to solve this problem. Certain general principles have been developed for the elimination of wastes by extending the manufacture of useful by-products from farm materials and providing a market for them. As a result of these efforts, by-products are daily becoming more significant as a source of revenue.

A PLACE FOR THE AGRICULTURAL ENGINEER

Development of new uses for agricultural raw materials and the manufacture of by-products, especially outside of the food-products field, is one of the duties of the agricultural engineer. He must make closer contacts between the farm and the factory by establishing himself in those industries which process farm products.

One example will suffice to illustrate the force of this point. In 1870 America produced about one million tons of steel. In 1925 we produced and used about 70 million tons of steel and at the same time kept a balance between production and consumption. Not all this increase in steel was caused by better production methods. A part of it came from the development of new markets and new uses, and with the increased output came mass production and the efficiencies and low costs that always accompany volume production.

Agriculture, if it is to prosper, must draft into its industry many of these principles and practices. Among the first must come new uses outside the food lines and better utilization of those things which are now produced. Greater attention must be paid to the utilization of the waste products of the farm. Agriculture must develop new uses for its products and it must develop new markets.

CERTAIN ESSENTIALS FOR BY-PRODUCT DEVELOPMENT

The development of any new markets for an agricultural raw material outside the food-products field must, from the economic point of view, be based on certain fundamental factors. There are few farm wastes for the use of which a process may not be made available provided a market awaits the possible product and the raw material can be assembled cheaply enough at one point. Unless the product and its marketing is sound in relation to all these factors, the product cannot be developed economically.

The several requirements on which agricultural by-product developments are based are:

(1) A practical commercial process of manufacture.
(2) Cheap and satisfactory storage from crop to crop.
(3) Adequate supplies of the waste used as raw material, gathered in one place or capable of being collected at a sufficiently low cost.
(4) Actual or potential market outlets for the new proposed by-products.
(5) Technically trained operatives.

A PRACTICAL COMMERCIAL PROCESS

In discussing the first requirement on which agricultural by-product development is based, that is, the necessity of a practical commercial process of manufacture, incidents from the experience of other industries may serve as illustrations.

Years ago the keeper of every meat market was his own butcher, and even when communities cooperated in establishing and operating an abattoir, it was still impossible for them to make any use of the wastes incident to butchering and meat packing. It was only when these wastes became accumulated, incident to the principal business of meat packing, that they could be used as raw material for other products. The famous work of the stockyards in allowing little of value to go to waste was impossible when the business was composed of small units. In large units the profits from materials otherwise merely wastes represent the largest proportion of earnings of the meat packing companies.

A practical commercial process was of prime importance in the manufacture of straw into by-products for varied uses. Long a waste product, straw is becoming a useful raw material and provides agriculture with a new source of income.

New factories are being built every year to utilize straw in paper and cardboard-box manufacture. However, it took the accidental explosion of gas generated in a straw-burning stove in a settler's shack on the plains of Canada about twenty years ago to start a series of experiments to determine the composition of straw. The results today show in one of the most unique factories in the world.

A young engineer and chemist spending a night in the shack determined, after the explosion, to ascertain just what straw contained. Correspondence with various colleges and universities revealed the fact that they knew nothing whatever of practical value on the subject. Following a series of experiments, gas was extracted in sufficient volume to be considered a feasible source of heat, light and power for the farmer, a small upright retort being the only equipment needed. Two years' work in the laboratories of one of our large universities proved that the real value of straw was not in the gas obtained, but in the other principal elements, that is, in the vegetable carbon, "straw oil" and vegetable pitch.

The next step was to perfect a continuous-process retort. This was accomplished, and a plant was then erected at St. Paul Park, Minnesota, and equipped to extract the various products on a commercial scale. At the present time three principal articles are produced in the factory: fly sprays and disinfectants, with the "straw oil" as a base; roofing and damp-proofing materials, with carbon and pitch as a base; and paints, auto-top dressing, enamel tire dressing, etc., with carbon as a base. In experimental work oat straw has been found the best, although wheat, barley, and rye straw can readily be used. Rice straw also contains many valuable elements.

More than fifty separate and distinct chemical elements have been isolated from straw oil. At the present time experiments are being carried out in several laboratories in the United States in connection with the use of straw oil for medicinal purposes for the human being. The ultimate possibilities in the use of straw carbon can only be guessed at. Time and the chemist alone, when a commercial process is developed, can reveal the hidden value contained in it. At the present time 1,600 pounds of useful products are being extracted from each ton of straw. Yet if a match were touched to a ton of straw, one would have left about 40 pounds of ashes, largely silicate.

Orginally straw was used in strawboard mills, but there is a decline in such use, and it would seem that today there is a tendency for straw to be utilized in other ways rather than in manufacturing cellulose or paper.

DEVELOPING A NEW PROCESS

The development of new processes is a difficult matter, and according to certain investigators chemical manufacture of farm wastes sounds better than it looks. As yet there is much speculation, but in many cases not much in the way of definite results. The future lies before it. However, the manufacture of furfural is significant of the possibilities, although we will not be able to develop this product fully until the chemists find out a great deal more about the uses of furfural than they know now.

When the first experiments on furfural were made, if it could have been bought, a pound would probably have

cost $100.00. Today in Cedar Rapids, Iowa, the world's only plant is in operation and is making over 5,000 pounds a day. For about a year it did a land-office business in giving this product away. When any use was suggested, the manufacturer donated the material to have it tried out. It was a generous and expensive policy, but the selling curve was trailing after the giving curve. Today the plant is making a profit and is an established industry in the state.

CHEAP STORAGE FOR RAW MATERIALS

A second basis for successful by-product manufacture is the requirement of cheap and satisfactory storage from crop to crop in the case of agriculture.

For example, celotex, a very successful building material, distinguished by its insulating properties, is now being manufactured at the rate of many millions of square feet per month from bagasse, which is sugar cane from which the juice has been pressed out or extracted. The crushing of cane is a seasonal operation, so that the storage of bagasse presents a problem, which, however, has been successfully met.

The production requires a large supply of raw material and indicates how successfully the market has been developed. The point to be emphasized is that bagasse is concentrated as the by-product of a prior industry—the manufacture of sugar—which bears the cost of collection. The waste is preconcentrated without charge to the board-making project.

There are other types of fibers which conceivably would make as good if not better building board. Cornstalks afford an example. There are millions of tons of cornstalks, but they are left in the fields as a by-product of the gathering of the corn crop. The storage of the cornstalk from one crop to another offers no such problems as the storage of bagasse, but under present methods of handling corn any industry founded upon waste cornstalk would have to bear the cost of collection and transportation ever a considerable radius—fifty or sixty miles—to the manufacturing plant.

This matter of the cost of collection of waste material for manufacture is a fundamental one and attempts at its solution are being made by various agencies.

COST OF COLLECTION INVOLVED IN CORNSTALK UTILIZATION

A consideration of these products leads to a discussion of the third requirement on which agricultural by-product development is based; namely, the need of adequate supplies of the waste of raw material, gathered in one place or capable of being collected at a sufficiently low cost.

Furfural, for example, can be made from corncobs or from oat hulls. It is made from oat hulls. Why? Corncobs would seem more plentiful than oat hulls, and the first research work on furfural was done with corncobs by the U. S. Department of Agriculture. Furfural is made from oat hulls because there was a point at which oat hulls as a waste from another manufacturing operation were already assembled in quantity. As a by-product in the preparation of rolled oats, it was possible for one of the large cereal companies to make the cost of the raw material for furfural a mere matter of bookkeeping.

The problem of the collection of cornstalks is very important in the commercial manufacture of by-products from them. A survey of the costs of collection at different points was made by Dr. George M. Rommel, of the U. S. Department of Agriculture, in the course of his investigation into the whole subject of by-products of agriculture, a fine piece of research which has been embodied in a comprehensive report and submitted to the Secretary of Agriculture[3].

Dr. Rommel, who is not so enthusiastic as Dr. Sweeney in discussing the utilization of cornstalks, makes some carefully weighed observations which are summarized in the succeeding paragraphs. Cornstalks have not been used in manufacturing to a great degree as yet because the uses for cellulose are only partially developed, because no one knew until last year how much the stalks would cost at a factory, and because stalks are not assembled in one large body, as is the case with trees or with straw from small grain.

Davidson[4] and Collins[5] were the first men to get engineering data on the cost of collecting cornstalks. With an outfit of their own contrivance, comprising a mower, a hay loader and a baler, hauled by a big tractor, they gathered cornstalks after the ears had been husked at a cost of $3.12 per ton on the farm. The yield was estimated at 0.8 ton per acre, moisture-free weight. To this cost they added $1.70 per ton for hauling to the factory. This hauling charge would not be so high where roads are good. The Bureau of Public Roads gives 8½ cents per ton-mile for the average trucking costs in the upper Mississippi valley.

Davidson and Collins' figures were carefully checked with those obtained by Harvey J. Sconce, director of raw material production of the Cornstalk Products Company, Danville, Illinois. Mr. Sconce collected 10,000 tons under all sorts of conditions—stalks alone and stalks with ears on them, the farmer getting the ears and the company the stalks—at an average cost of less than $8 per ton delivered to the factory. One lot of stalks was hauled twenty miles to the factory and laid down at a cost of $5.70 per ton. It is believed that in 1928 the average cost will be reduced to $6 a ton, and the company states that it has set its goal at $5 a ton delivered, without reducing the compensation to the farmers.

Cornstalks will average from 2 to 2½ tons per acre on good corn land, according to the records of the Illinois Agricultural Experiment Station. The varieties grown in these tests were commonly grown for grain, and it is believed that stover yields can be greatly increased when it pays to do so. As competitors with cornstalks for the uses already discussed, it is of interest to note that the only trees commonly found in our forests which equal or surpass corn as an annual producer of cellulosic material are the southern pine, ash, Douglas fir, and redwood.

What is needed to make the utilization of cornstalks a general source of revenue for corn-belt farms is a demand which calls for heavy tonnage. About 50 per cent of the gross weight of cornstalks is the leaves and husks, which have some feed value. Animals will not eat the stalks (stems) unless they have been insiled or shredded. With the coming of the corn borer, the need of shredding and otherwise treating cornstalks will increase the desirability of their manufacture and may give farmers an opportunity to salvage something from their battle with this pest.

This whole work with cornstalks is a great experiment. The cellulose in cornstalks will be in demand some day. Time will tell whether that day is now.

Speculation regarding the fertility value of cornstalks is idle; they rot slowly. The bacteria which decompose cellulose act only in the presence of nitrogen. If it is not there it must be added; otherwise the cellulose will decompose at the expense of the nitrogen already in the soil. Until we have more accurate chemical data, it is probably safe to be cautious about accepting estimates of fertility values of stover based on past experiments.

The whole problem of the collection of material raises the question of the extent to which the farmer can be expected to alter his present practice for the sake of utilizing his waste materials. The gathering and husking of corn are estimated to cost at least 7 cents a

[3]The substance of this report is published under the title "Farm Products in Industry" by the Rae D. Henkle Co., Inc.

[4]Professor and head of the department of agricultural engineering, Iowa State College. Charter A.S.A.E.

[5]Agricultural engineer, Iowa Agricultural Experiment Station. Mem. A.S.A.E.

bushel under present conditions, and farm hands are often scarce. Mechanical corn cutters have met with some success, and it is conceivable that a machine could be perfected that would cut but not husk the corn in the fields, be light enough to work over soft ground, and inexpensive enough to be attractive to the corn farmer.

Such a machine might deliver the whole stalk to the wagon which, used as a trailer, would serve to transport stalk, ear and all to a central mechanical husking plant. This plant would shuck the corn at a much lower price than can now be done by hand and, incidentally, afford a concentration point for the stalks destined for the factory. In addition to a change in agricultural procedure, such a scheme also involves a payment per ton for stalks that would make this attractive to the farmer, besides enabling him to use his equipment and employ his help to advantage throughout the winter.

ECONOMICAL ASSEMBLY A PROBLEM WITH OTHER FARM WASTES

A great deal of work has been done on the use of waste cereal straws, and much strawboard is made from such raw materials. The flax straw remaining after the flaxseed has been threshed has also received attention, and an excellent grade of paper, almost good enough for banknotes, has been produced from this fiber.

Here again it is the concentration of the straw that is the important economic factor. Its use in paper making would involve the preparation of tow at small decorticating plants, in which the woody fiber would be removed mechanically, and this tow would have to be shipped to a central chemical-treating plant. The process is ready, its value has been proved on a semi-commercial scale, but the economics of collection are not satisfactory. Some flax straw finds its way into insulating boards and floor coverings, but the development of these industries is again dependent upon the cost of collection.

Wheat straws have been subjected to destructive distillation with a view to making a gas useful on the farm for light, heat and power. Here the need for technically trained operators is important, and there would seem to be too great a hazard in the operation of such plants in unskilled hands.

MARKETS AND MARKETING FACILITIES MUST BE PROVIDED

Finally, in the development of new products from agriculture, there must be actual or potential market outlets for them. A case from Hawaii may be cited where the other conditions for successful by-products development were met, but there was lack of a market. The sugar refiners in Hawaii at one time found it more advantageous to dump their residual molasses into the sea than to convert it into industrial alcohol. Methods for conversion were well known, the waste molasses was concentrated, there was no difficulty in storage nor in obtaining men technically trained to operate the process, but the market had not yet been sufficiently developed.

Since then the growth of our chemical industry and the increase in the number of automobiles operated through out the cold weather have helped to create an enormous demand for industrial and denatured alcohol. Today not only is the molasses of Hawaii used in this process, but molasses is even brought from East Africa and other distant points to supply the fermenters in the huge alcohol plants of this country.

The discovery of new products and the successful marketing of them are two phases of one problem. At the present time marketing requires even more attention than discovery. Principles and methods of distribution are undergoing rapid changes. Mass production has given way to merchandised production. This merchandised production may be defined as the balancing of production or purchasing schedules with carefully determined sales possibilities in such a way as to obtain the greatest net profit consistent with reasonable risk.

GENERAL CONSUMPTION ALMOST LIMITLESS

Newness or style has become the order of the day. This element of style has rendered saturation points more difficult to reach. The American consumer is a product of evolution, and he is now ready to absorb huge quantities of by-products. From a homely individual endowed with a ravenous appetitie, the American consumer has taken on many characteristics of the sophisticated man of the world. The battle among manufacturers is one fought to win the consumer's loyalty. Those who can pull a "wanted article" out of the fire of their ingenuity will find as instantaneous success at their feet as if they had touched Aladdin's lamp.

While there is some theoretical limit, there is no practical limit to human desires. To food products there is a limit in consumption, but there are other wants just as real as food which have no such limitations because they are desires which are ever on the increase. There may be limits to the consumption of a particular product; there is no limit to general consumption possibilities.

To those who feel, in spite of this, that there is a limit to the effective use of the industrial capacity of the country, history should relate its own reassuring story. If to the leaders of the American industry of fifty years age some wildly romantic business prophet had suggested the possibility of the actual production figures of any recent year his story would have beeen summarily dismissed and his sanity seriously questioned.

American industry and business have rolled on with whirlwind speed. There is no reason for believing that such speed can be slackened either by the obstacles that may confront business or by by the diminution of the energy inherent in business. Each industrial or agricultural institution must of necessity forge its own way to success. But both industry and agriculture can plan and execute their advancement secure in the belief that there are no limits to the total productive capacity of the country and the resulting purchasing power, because there are no limits to the needs and desires of American consumers. If the battle for the consumer's loyalty is waged effectively and ethically, it is possible to look forward to its results, not with fear and misgivings, but with faith and assurance.

ORGANIZED RESEARCH PROGRAM WOULD OPEN NEW FIELDS

No discussion, however inadequate, of this great problem, should be concluded without some recommendations for a future program. In developing possibilities for new markets for farm products it is necessary, in my judgment, to deal with the problem on a national scale. As a first move I would suggest that a census be taken of all research projects now under way in this field. Such a census throughout the United States would be similar in character to that made last year on economic projects by the American Farm Economic Association. This census might be carried out through some national research institution, governmental or privately endowed.

All things are possible to those who are not afraid of research. No one suffers from the effects of new discoveries when he makes them himself. The agricultural industry must organize its chemists, engineers and economists in a research program which will assure progress. Every phase of the industry must be covered and every problem treated in all its phases. Such comprehensive treatment will go far towards solving the problems of the development of markets for new products of agriculture.

In urging this program I should like to emphasize again the thought mentioned at the opening of my address, that this subject must be treated from a long-time point of view. It is the duty of students of agriculture to look into the distant future and to build in the light of the knowledge of the past in order to meet the needs of coming generations.

Some Problems in Farm Home Making[1]

By Mrs. Chas. M. Sewell[2]

WE BELIEVE firmly that in the homes and in the communities of the farm people there must be first created and later crystalized a sentiment that will give to the farm people the things for which they are seeking. Our attempt to create an adequate standard of living in the farm home and create an income from that farm to pay the bills is a very timely one, and one which has given a great deal of concern to the people who have been directly busying themselves with it in the last few years.

Today the American farm home has within it the things that go to make the ideals of a real home. And it is those things that we are struggling to preserve. That is the reason we are concerned with the material things that go into home making—the means for the accomplishment of a larger purpose.

The farm home has been rather neglected as regards architecture and the real needs of the farm home and the people who are to live there. Last year the American Farm Bureau Federation began with a contest for farm home plans which was a great success. I thought it would be fine if we got 500 or 600 answers. When we had more than 6,000 plans submitted with good descriptions, we were naturally delighted. And many of these were very much worth while.

There were differences in these farm home needs, plans and descriptions from those of city homes. Nearly every one of the plans submitted made some reference to a place in which the hired man might be housed because, particularly in the middle west, he is still a part of the household.

There is generally the care of milk on the farm, even on the smaller farms. It doesn't necessarily mean you have to have a dairy, but it does have to be taken into consideration.

Another thing is the fact three meals a day are still cooked in the farm home. And the laundry work is also generally done in the farm home.

In one of the plans in the prize-winning class was the statement, "We want a living room large enough so that we can entertain the neighbors or some friends in our particular community." The living rooms of city apartments do not call for any such need at all.

Another thing we cannot leave out of the picture is the fact that in order to make the farm home convenient with light, heat, water and sewage disposal, it is necessary in the main for farm families to own their own plants. We have had in our home a farm lightning plant for nearly ten years. My hair would have become a great deal more gray than it is, if I had waited for central station electric service to come to me. There are scores of farm women like me who want electricity in their homes. It pays me greatly.

About all the Pilgrim fathers were able to accomplish was a shelter of some sort to protect them from the elements. The next thing was to furnish something of comfort and convenience for the family who must occupy that home. And so we have turned our thoughts lately to the home modernizing idea, because with approximately 40 per cent of the farm homes of the country mortgaged to the limit and 41 per cent operated by tenants, we don't suppose it will be possible to do all the building that ought to be done in the very near future. One of the economists of the U. S. Department of Agriculture has estimated there should be expended annually $575,000,000 in farm buildings, while the fact remains that last year but $278,000,000 were expended, or a little more than half.

I had the great privilege recently of going to South Dakota where I found a piece of work that is of interest to you—an economic conference—in which representatives of the U. S. Department of Agriculture and the extension service of the state college, the county agricultural agent, the home demonstration agent, together with the farmers and their wives, held a two or three days' conference in which the women mapped out what they considered to be an adequate standard of living in their county. Then it was up to the men to evolve a system of farming that would produce a sufficient income to afford that standard of living.

To my way of thinking the figures which these women arrived at are entirely inadequate, but I want to tell you about some of the things they have put down with regard to housing and buildings.

They were unanimous in agreeing that running water was the biggest factor in lightening the home work and safeguarding the family health. The survey brought out that 84.6 per cent of the homes have running water. This is Brown County, South Dakota, and this high percentage is probably due to the fact that the water supply is largely from artesian wells.

Then 44.5 per cent have hot water in the kitchens of their homes; 33 per cent have bath tubs; 32.6 per cent have flush toilets. For water disposal, a great many of the homes just have a pipe leading from the kitchen into the yard. The committee felt that every home should have running water and sewage disposal. And here is a thing I am sure you will be interested in; they advised running water in the house as a means of fire prevention.

I have always maintained, if I had to give up one by one the conveniences which have been given to me, that the one thing I would part with last would be the kitchen pump and sink installed by my husband a good many years ago. And the next would be the disposal of water from the kitchen. Next in order would be the hot water tank, the flush toilet and the lavatory.

The discussion brought out that the second major improvement to look forward to was electricity. This showed that 33 per cent had electricity, 12 per cent of which was from power lines.

Next the committee felt a furnace of some kind should be furnished in all homes. The survey showed 41.4 per cent already had a hot air furnace or pipeless furnace.

The question of financing the building of the farm homes to me is something that you might well consider. Your chairman referred to the number of homes that are financed by building and loan associations all over the country; that has proved a popular way for laboring people to pay for a convenient, modern home and have the joy of home ownership while they are paying the bill very much like rent. There is no provision, as far as I have been able to learn for financing that kind of proposition for the farm home.

In summarizing I want to repeat this tribute to the American farm home by an eminent personage on a visit to this country several years ago. He had visited the country along the Atlantic seaboard and was taken for a tour of the farm homes in Pennsylvania and New Jersey. He said as he returned to New York before sailing for his own home: "America is not going to suffer any moral, financial or social catastrophe, and what is going to save her are the traditions, principles and ideals kept alive and fostered in her millions of fine country homes."

[1]Address before a meeting of the Structures Division of the American Society of Agricultural Engineers, at Chicago, December, 1929.

[2]Director of home and community work, American Farm Bureau Federation.

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture. Requests for copies of publications abstracted should be addressed direct to the publisher.

Moisture Content of Flaxseed and Its Relation to Harvesting, Storage, and Crushing, A. C. Dillman and R. H. Black (Journal of American Society of Agronomy, 21 (1929), No. 8, pp. 818-831, figs. 1).—Recent observations and tests by the authors in Montana, North Dakota, and Minnesota on the moisture relations of flaxseed in growth, maturity, harvest, and storage are reviewed.

The growing young flaxseed contains a high percentage of moisture which gradually declines toward maturity. In the growth of the seed a more or less steady increase in dry weight is coincident with a decrease in moisture content. After the growth of the flaxseed is completed, the ripening process is chiefly a matter of dehydration or drying of the seed. This drying process proceeds very rapidly under favorable climatic conditions. The whole bolls and the chaff of the threshed bolls appeared to be much damper than the seeds, suggesting that the seeds may ripen earlier than the boll and more or less independently of it.

In clean, mature flax no advantage appeared in harvesting with the windrow harvester, so far as reducing the moisture content was concerned. Where weeds are present, or in case it is desired to harvest before the crop is fully ripe, the windrower makes it possible to harvest before the crop is ready to combine. All observations indicated that the moisture content of the seeds in standing flax increases rapidly after light rain or heavy dew and is responsive also to changes in humidity. When the moisture content of the seeds is high, a marked reduction in moisture may occur during the day. The rapid rate of drying on a clear day was shown by the moisture content of seeds from standing flax collected at hourly intervals.

The higher moisture content of the seed from the combine than from the standing flax indicates that the threshed seed took up moisture from the weed seeds and chaff present in the combine samples. After flaxseed containing dockage is placed in storage, moisture is transferred from the weed seeds to the flaxseed until there is equilibrium of moisture in the various contiguous seeds. Ordinarily when this balance is reached, the dockage contains from 1 to 3 per cent more moisture than the flaxseed.

At University Farm, St. Paul, Minn., there was no significant difference in the yield per acre of the Redwing variety from the five dates of harvesting, and no decrease in acre yield occurred from the later dates of harvest at Morris, Minn.

It seems probable that clean flaxseed containing not over 11 per cent of moisture is safe for storage in cool weather, and that flaxseed containing from 10 to 11 per cent of moisture may be considered safe for storage under average conditions. It was evident that flaxseed which varies greatly in moisture content also has a considerable range in value.

Methods of Winter Wheat Tillage, A. L. Nelson (Wyoming Station Bulletin 161 (1929), pp. 37-52).—Further experiments in winter wheat production showed that furrow drilled seedings outyielded those made with the common drill. Yields from early and late plowings were similar when furrow drilled, while late plowing was better when seeded with the common drill. While duckfoot (unplowed) fallow produced slightly less than plowed fallow when furrow drilled, the difference hardly justified plowing. Seedings with the common drill yielded on duckfoot fallow about midway between yields from early and late plowed fallow. In 1928 early tillage with the duckfoot produced larger yields than when such tillage was delayed until late spring or early summer, and straw left on the land did not reduce the yields.

Subsoiling, plowing, listing, and disking have been about equal in winter wheat production on land continuously cropped to winter wheat or when winter wheat is seeded in the stubble of other small grains. Plowed winter wheat stubble plats averaged about the same as unplowed winter wheat stubble plats. Seeding in oat stubble had no advantage over seeding in winter wheat stubble. Seedings of winter wheat in corn rows with the corn row drill produced yields slightly less than spring wheat seeded on disked or duckfooted corn ground. The best seeding rates were about 2 pecks per acre with the furrow drill and on about September 1, with August 15 and September 15 seedings also producing good yields.

Tillage Practices in Relation to Corn Production, T. A. Kiesselbach, A. Anderson, and W. E. Lyness (Nebraska Station Bulletin 232 (1928), pp. 19).—Investigations to compare different methods of seedbed preparation, planting, and cultivation used in growing corn and concerning the effects of intertillage and of cropping upon the moisture and nitrate contents of the soil ranged from 6 to 12 years in duration.

Early spring plowing yielded 12 per cent more grain per acre than late spring plowing and 13 per cent more than fall plowing. With late spring plowing, a previous early spring disking increased the yield 7 per cent. Plowing early in the spring from 4 to 10-inch depths yielded from 31.4 to 36.4 bushels per acre, although plowing deeper than 7 inches seemed impractical.

Among six methods of planting corn in furrows with either the lister or furrow attachment to planter, the extreme variation in yield was only 2 bushels per acre. The best listing practices, either double listing in the spring or single listing preceded by early spring double disking, yielded slightly less than the best surface planting practice on plowed ground. Practically equal yields were had from corn surface planted in hills or in drills, provided the stands were comparable. In corn rows 7 feet apart, i. e., double distance, the grain yield was reduced 23 per cent when the stand per row remained normal and was reduced 14 per cent with twice the normal number of plants per row such as to provide the normal acre stand.

The planting rate may vary somewhat without affecting very materially the grain yield per acre. Checked corn with hills 3.5 feet apart and stands of 1, 2, 3, 4, and 5 plants per hill yielded at the respective rates of 36.8, 45.4, 48.7, 46, and 42.9 bushels per acre. An average of 2.5 to 3 plants in hills 3.5 feet apart or its equivalent in drilled corn appeared most practical for standard varieties in eastern Nebraska. Where 51.4 bushels per acre were obtained from a uniform stand of three plants per hill, alternating hills with 2 and 4 plants yielded 52.3 bushels, with 1, 2, 3, 4, and 5 plants yielded 51.6 bushels, and alternating hills of 1, 3, and 5 plants yielded 50.3 bushels, indicating that the irregular distribution of plants averaged equally with the uniform, the same number of plants being grown per acre.

Corn cultivated normally, 0, 1, 2, 3, and 4 times, respectively, yielded 7.1, 21.6, 33.6, 35.9, and 37.2 bushels per acre. Continued late cultivation after corn was laid by normally reduced the yield 2 bushels. Plats merely hoed to prevent weed growth yielded 2.1 bushels less than corn receiving four normal cultivations. With a 6-shovel cultivator shallow cultivations averaged 35.8 bushels, medium 37.2, deep 38.1 and close cultivation 36.2 bushels per acre.

Little or no relation was noted between the type of tillage treatment and the reduction of soil moisture during the growing season. In corresponding fallow areas, however, plats merely scraped to control weeds, conserved moisture slightly less effectively than plats cultivated normally. There was indication that normal cultivation was conducive to a somewhat increased rate of nitrification as compared with scraping to prevent weed growth.

Improved Methods of Harvesting Grain Sorghum, J. P. Conrad and E. J. Stirniman (California Station Bulletin 477 (1929), pp. 41, figs. 19).—The merits of different methods of harvesting grain sorghums are described from observations and from experiments at the station and in cooperation with growers.

High percentage of water in stalks, leaves, and sometimes in seed has caused most of the difficulties in harvesting grain sorghum. Agromomic studies suggested that adjusting the stand to the moisture supply and to the soil fertility is necessary for best yields and for uniform maturity. Thick stands, early planting, adequate irrigation during the early stages of growth, and no irrigation after the heads appeared gave good yields on fertile soil in many situations in the State.

Hand heading and combining, the principal methods used, have certain adaptations and disadvantages. Machine heading and binding also are employed to some extent. The combining of grain sorghum is increasing because the work can be done easily and cheaply with proper adjustments and under favorable conditions.

Cutting the roots at from 5 to 7 inches below the soil surface to sever the plant from the moisture supply was found to cause rapid drying of the grain, stalks, and leaves in dry fall weather, so that combining may often follow safely in about 10 days. Special attention to varieties and to spacing of rows was shown to be necessary. Where the taller sorghums and the usual types of tractors are used, alternate wide and narrow spacing of rows is usually essential, while the Double Dwarf varieties and a row-crop tractor normal spacing of rows proves

satisfactory. The drawbar pull for cutting has varied with different soil conditions from 350 to 2,250 pounds for a single row of sorghum. It was estimated that the operating cost of root cutting, where the soil is free from obstructions and the crop spaced adequately, should range from $0.75 to $1.50 per acre.

Cost and Efficiency in Producing Alfalfa Hay in Oregon, H. E. Selby (Oregon Station Bulletin 241 (1928), pp. 72, figs. 26). —This bulletin presents information on the costs of producing alfalfa hay in Oregon, the factors affecting the costs, and the methods of reducing different costs. It is based chiefly on 632 records obtained in 1925, 1926, and 1927 from representative farms in the Malheur, Baker-Union, Umatilla, Deschutes, Klamath, and Rogue River areas. Tables are included showing for each area and for the six areas the average costs per acre and per ton by items, the average cash and noncash cost per acre, and the average costs per acre and per ton for each year.

Harvesting methods and equipment, other factors affecting efficiency in haying, yield and factors affecting it, and the costs of establishing a stand of alfalfa are discussed, with tables and charts showing the effects of different items and factors on yields and costs. Other tables are included and discussed showing the man labor and horse work used in different areas, the acreage of alfalfa and other crops, number of livestocks of different kinds, investment per farm and per acre of alfalfa, percentage of alfalfa sold and fed, and the prices received per ton in the different areas.

The appendixes include supplementary and detailed tables, and tables showing costs by items of producing alfalfa hay in the Willamette Valley and of alfalfa hay and wild hay in the Harney Valley.

The average cost of production for the six areas was $27.06 per acre and $7.96 per ton. The average cost of harvesting was $3.42 per ton using wagons, and $2.94 using buck rakes. Of the total average cost, cash items constituted 41 per cent, labor of operator and family 22 per cent, depreciation 9 per cent, and interest 28 per cent. The average cost in each area varied but little from year to year, but there was considerable variation both between different farms in the same year and the same farms in different years. The cost of production per ton decreased from an average of $15.34 for yields of less than 2 tons per acre to $5.78 for yields of 6 tons or over.

Tillage Investigations (Kansas Station Biennial Report 1927-28, p. 25).—Various methods of preparing the seedbed, including differences in the depth and date of plowing, were compared in the production of wheat crops, soil moisture, and soil nitrate determinations having been made at varying intervals since 1910. The results are considered to show "that in eastern Kansas the time of preparation is the most important factor in determining the yield of the wheat crop. Early plowing . . . has resulted in a gain in yield of 8 bu. per acre as compared with late plowing. The reason has been shown to be the relation between time of tillage and the development of nitrates in the soil, more nitrates being available when the land is plowed early. For the same seedbed treatment the yields average 5 bushels per acre greater for wheat grown in rotation than for wheat grown continuously."

The Effect of the Combined Harvester-Thresher on Farm Organization in Southwestern Kansas and Northwestern Oklahoma, W. E. Grimes, R. S. Kifer, and J. A. Hodges (Kansas Station Circular 142 (1928), pp. 24, figs. 6).—This circular, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics and the Oklahoma Experiment Station, discusses primarily the problems of size of farm and the combination of crops and livestock most desirable for farms of various sizes in southwestern Kansas and northwestern Oklahoma. A table is given showing the power and crew requirements, number of cutting days required, and cost per acre of harvesting 50, 100, 200, 300, 400, and 500 acres with binders, headers, and combines. Plans are outlined for the organization of farms with 360, 480, and 960 acres of wheat, and tables are included showing the estimated receipts, expenses, and financial statement for such farms. The land needed for other crops and pasture, cropping systems, livestock needed, equipment, capital requirements, etc., are discussed.

Frost and the Prevention of Frost Damage, F. D. Young (U. S. Department of Agriculture, Farmers' Bulletin 1588 (1929), pp. [2]+62, figs. 39).—This is a revision of and supersedes Farmers' Bulletin 1096 (E. S. R., 43, p. 237).

Opening with a general discussion of the nature and causes of frost and the influence of land contour, soil moisture, ground covers, etc., on frost occurrence, the author follows with a comprehensive discussion of frost protection. The three principal means of protection, namely, covering to conserve heat, mixing and stirring the air, and the addition of heat, are considered, with principal stress on the last, which is deemed the only practical large scale method. The success of orchard heating is said to lie primarily in the fact that on cold, clear, calm nights there is usually a low ceiling of warm air which prevents the rise of the heated air, thus confining it to the lower stratum where needed. Small orchards are more costly to heat per unit area because of the drift of air even on calm nights. That smudging has no disastrous influence on pollination was indicated in a fine set of pears on trees that were smudged every night during the blooming period.

Orchard heating practices are discussed in detail, with remarks on the type of heaters, fuels, placement in the orchard, filling, lighting, care, etc. The economic phases are considered and data presented on the critical temperatures for various fruits in various stages of development. The types of injury resulting from frost are illustrated and discussed, and various instruments useful in determining humidity and temperature are described.

Electric Stimulation of Plant Growth, G. N. Collins, L. H. Flint, and J. W. McLane (Journal of Agricultural Research [U. S.], 38 (1929), No. 11, pp. 585-600, figs. 5).—Following the report of Sir Oliver Lodge on the effect of electricity on plant growth, field experiments were conducted by Briggs, et al., which have been noted. After Blackman published the results of his laboratory work, the authors undertook electroculture experiments under controlled conditions in which seedlings of maize and barley were subjected during their early period of development to conditions of modified atmospheric electrical gradient. Difficulty was experienced in providing a uniform environment that would eliminate significant differences in the rate of growth cultures given the same treatment. This is said to have shown that in many instances the association between treatment and a changed rate of growth was not in the nature of cause and effect, and to indicate that in experiments of this nature caution should be exercised in accepting conclusions based on the statistical significance of one type of experiment.

By exercising great care in the preparation and planting, four experiments were conducted in which two of the boxes containing the plants were subjected to a charge from the overhead network that induced a total discharge equal to 10^{-9} amperes per plant. In none of these experiments was there a measurable difference between treated and control in either weight or elongation. An analysis was made of three of the most satisfactory experiments, in which the plants were sorted according to their initial size, and when comparisons were made of the elongation of treated and control plants of the same initial height, no significant differences were observed.

To test further the possibility of a detrimental effect of excessive currents, an experiment was undertaken with the maximum current possible without sparking. Even this excessive current did not produce any significant change in the rate of growth.

A Field Test of the Effect of Artificial Light on the Behavior of the Codling Moth, Carpocapsa Pomonella Linn., W. B. Herms (Journal Econ. Ent., 22 (1929), No. 1, pp. 78-87). —"Six 500-watt lights were suspended directly over a block of 15 trees consisting of several varieties of apples. The plat was flooded with light each evening for 2.5 to 3 hours from April 26, to June 30, i. e., to the end of the first brood of codling moth. Temperature for the period was recorded, and foot candle meter readings were made to ascertain light intensities. Comparing fruit of the same variety at the end of the test it was found that 21 per cent of the apples on check trees outside the test plat were moth attacked, while only 14.5 per cent of the apples inside the test plat were so affected. Light of the intensity and quality used indicates a tendency to deter codling moth in its egg-laying habits."

Metals in Dairy Equipment: Metallic Corrosion in Milk Products and its Effect on Flavor, O. F. Hunziker, W. A. Cordes, and B. H. Nissen (Journal of Dairy Science, 12 (1929), No. 2, pp. 140-181, fig. 1).—To study the corrosive effect of milk and milk products on the various metals used in dairy equipment and the effect of the metals on the milk products, the authors observed 19 different metals, plated metals, and metallic alloys. A strip of each metal was placed in the following solutions: Four organic acids, 2 mineral acids, sweet and sour milks and creams, and sour cream neutralized. Some of the strips were fully immersed in the solutions, and others were immersed to the extent of one-half of their length for periods of 5 days at 70 degrees (Fahrenheit) and for 5 hours at 145 degrees. Other strips provided with rivets of different metals to study the effect of metals with different electrical potentials in contact with one another were used. Each strip was weighed before and after immersion and examined for corrosion. In addition, the liquids were studied as to color, precipitates, flavor, and in some cases for metallic salts.

The corrosive effect on the metal was generally more noticeable in the acid solutions than in the milk products, even when the acidity of the milk product was equal to or greater than that of the acid solution. Corrosion was greater on the whole in the high acid products and at high temperatures, although it was not entirely absent in the sweet milk products

and at room temperatures. The metal showing the most definite corrosion also had the most marked effect upon the flavor of the milk products.

Based on the effect on the flavor of the milk product and their dependability under conditions of steam, washing solutions, and cooling brines, the metals may be listed as follows according to relative merit: (1) Allegheny metal, tin, and heavily tinned copper; (2) nickel, aluminum, and manganese aluminum alloy; (3) Monel metal, Enduro, Ascoloy, and nickel silver; and (4) tinned iron, copper, galvanized iron, iron, and zinc.

A Study of the Effectiveness of Sodium Hypochlorite in Sterilizing Creamery Equipment, E. L. Fouts, (Journal of Dairy Science, 12 (1929), No. 1, pp. 51-59).—In order to determine the value of commercial sterilizers for destroying bacteria on creamery equipment, the Oklahoma Experiment Station studied chlorine compounds and their use in sanitary piping, pumps, filters, and surface coolers to prevent recontamination of pasteurized milk from these sources. During the control part of the work ordinary washing methods were used, consisting of scrubbing with a hot alkali solution and rinsing with scalding water before using. The same washing methods were used in the experimental part of the work, followed by a solution of the chlorine compound. Samples of milk for bacterial analyses were taken from the vat after pasteurizing and from the trough of the cooler after the milk had passed through the pump, pipes, filter, and over the coolers.

It was found that ordinary washing methods followed by a rinse of scalding water did not sterilize dairy equipment. Sodium hypochlorite and its compounds were effective sterilizing agents when prepared according to the directions of the manufacturers, provided they furnished a minimum of 45 parts of active chlorine per million parts of solution. Sterilizing the equipment with sodium hypochlorite held the bacterial increase from pasteurizer to bottle to 10 per cent.

Temperature Relations of Crop Plants (Kansas Station Biennial Report 1927-28, pp. 34-36).—Some of the results are given of studies on the relation between the resistance to low temperatures and winter killing of annual plants, the relation of winter killing to hardening off, and the effect of chilling at temperatures somewhat above freezing on summer plants.

Artificial freezing was found to be a promising method of determining the winter hardiness of unknown strains of plants. The absolute as well as the relative ability to withstand low temperatures was found to depend very largely on the temperature to which the plants were subjected before freezing, and in some varieties a longer time was required to acquire hardiness than in other ones.

Studies in 1926-27 of 10 varieties of wheat showed that they fell into three distinct groups—relatively hardy, fairly hardy when hardened before freezing, and nonhardy. Later studies confirmed these conclusions and also placed winter rye in the class with Kanred and Kharkof wheats as to hardiness. Winter oats proved less hardy than winter barley and winter barley was less hardy than the most susceptible varieties of wheat when frozen in an unhardened condition.

The Influence of Light of Different Wave Lengths on Seed Germination [trans. title], E. Kommerell (Jahrb. Wiss. Bot., 66 (1927), No. 3, pp. 461-512, figs. 18).—Quantitative experimentation on light wave length as a factor influencing germination in seeds of Lythrum salicaria and Nicotiana tabacum is detailed as to method, results (which are tabulated), and indications. The yield in plantlets produced is said to have been within limits directly proportional to wave length.

The Effect on Plants of Radiations from a Quartz Mercury Vapor Lamp, E. M. Delf, K. Ritson, and A. Westbrook (Brit. Jour. Expt. Biol., 5 (1927), No. 2, pp. 138-154, pls. 2, figs. 4).—The general plan of this work was to determine the effect due to exposing plants growing under otherwise normal conditions to the full rays of a quartz mercury vapor lamp during short periods at different distances. Separate accounts are given of investigations as carried out independently by Ritson at Kew Gardens during August to November, 1926, and by Westbrook at Bedford College, Regent's Park, in August and September, 1926, the results from the two sets of tests being on the whole very similar.

A number of plants named grown in a greenhouse under full daylight were exposed daily to radiations from an Ulviarc lamp during intervals ranging in the different experiments from 30 seconds to 10 minutes. Exposures of 1 minute and upwards produced stunting and other effects as regards form and formation, though exposures of 30 seconds on Trifolium seedlings 6 weeks old showed no stunting but a favorable after-effect. Exposures of 2 minutes given to Voandzeia receiving also natural illumination during only from 5 to 7 hours daily gave more serious effects than when this treatment was given to plants having a 12-hour exposure to sunshine.

The Effect of Irradiation on the Electrokinetic Potential, Agglutinability, Lysis, and pH of Escherichia Coli, and a Comparison of Results Obtained with the Northrup Kunitz Cell and the Falk Capillary Cell, M. W. Lisse, G. R. Sharpless, and R. P. Tittsler (Pennsylvania Station Bulletin 243 (1929), pp. 6, 20).—Both maximum and actual values of electrophoretic velocities indicated initial stimulation accompanied by an increase in charge and later destruction accompanied by a decrease. Short-time irradiation was followed by a return toward normal. A decrease in charge was accompanied by an increase in agglutinability, lysis, death, and an increase in pH. Electrophoretic studies appeared more sensitive than agglutination studies as a measure of the effect of irradiation. Evidence was secured that Mazda lamplight acts similarly if the irradiation is carried on long enough. Both of the cells employed proved suitable for electrophoresis studies.

Observations upon the alfalfa root-nodule-forming organisms indicated that differences in electrophoretic measurements are associated with differences in nitrogen-fixing ability.

All-Night Lights for Winter Layers, D. C. Kennard (Ohio Station Bimonthly Bulletin 141 (1929), pp. 195-198).—In a demonstration of all-night lights for layers, 3 groups of 40 Leghorn pullets each were started on December 1. The groups averaged 19 per cent egg production when the lights were turned on, 39 per cent 2 weeks later, and 57 per cent after 4 weeks of lighting. These birds laid 49 eggs each to March 1, and the mortality to June 15 was 12.5 per cent. Another lot with a 40 per cent production before being lighted increased to 65 per cent in 2 weeks and to 75 per cent in 4 weeks. The pullets in this lot laid 57 eggs each from December 1 to March 1, with a mortality of 12.5 per cent. In another test 24 January-hatched pullets, averaging 45 per cent production, were moved from the range on July 15. Loss of production and molt followed the moving. From October 1 until they received lights only 2 birds were laying, but 2 weeks after lights were turned on practically all birds were laying, and from this time to April 1 production averaged 63 per cent with a mortality of 16 per cent to June 15.

Metals in Dairy Equipment—Corrosion Caused by Washing Powders, Chemical Sterilizers, and Refrigerating Brines, O. F. Hunziker, W. A. Cordes, and B. H. Nissen (Journal of Dairy Science, 12 (1929), No. 3, pp. 252-284, figs. 2).—In this study the authors exposed the metals used in work previously noted (E. S. R., 61, p. 563) to various dairy cleaners, to chemical sterilizers, to neutralizing lime, to refrigerating brines, and to successive treatment with steam, cooling water, and brine. A strip of metal 4 inches long was placed in a jar with enough liquid to cover one-half of its length. In the case of washing powders, the metal strips were exposed to their action for 5 hours at 150 degrees (Fahrenheit), for chemical sterilizers 5 days at 70 degrees, and for brines 10 days at about 32 degrees. A special experiment was also conducted in which the strips of metal were steamed for 2 hours, held in cold water for 2 hours, then in cold brine for 2 hours, and placed in open bottles overnight. This process was repeated for seven consecutive days. Before exposing the metal strips to any solutions they were washed in a dilute solution of trisodium phosphate, rinsed in water, wiped dry, dried in an oven, and carefully weighed. At the end of the exposure this process was repeated. Observations were also made of the visible corrosion on the strips and the appearance of the liquid.

Aluminum products corroded more than other metals in the washing solutions, the weight losses of three aluminum products accounting for more than two-thirds of the total weight losses of all metals. Tinned copper and tinned iron were also corroded, but their resistance was greater than in the case of aluminum. Of the remaining metals none showed any appreciable weight losses but nickel silver tarnished to a marked extent in some solutions, and copper, iron, galvanized iron, and zinc corroded to some extent. The corrosion of aluminum products in alkali washing solutions was avoided by treating sodium carbonate with small amounts of silicate of soda, while the corrosion of tin-plated copper and iron was reduced to a negligible amount by chromate treatment of trisodium phosphate.

Of the tree chemical sterilizers used, the sodium hypochlorite was the most corrosive. Because of its alkaline properties, Diversol was destructive to aluminum but was the least corrosive to the other metals. On the tinned products chloramine-T showed less intense action than sodium hypochlorite, but had a more corrosive effect than Diversol. Allegheny metal and Enduro showed no visible corrosion in any of the above sterilizers, and Ascoloy, nickel, Monel metal, and nickel silver were attacked but slightly. Neutralizing lime was particularly severe on aluminum products, and zinc and galvanized iron were also corroded and lost weight. The effect on other metals was slight.

Nickel and Allegheny metal were practically immune to the corrosive effect of either neutral sodium chloride brine or neutral calcium chloride brine, while Enduro, Ascoloy, Monel metal, nickel silver, and tin showed but slight attacks. Copper and tinnned products, particularly the latter, showed considerable corrosion in brine. In alkaline brines aluminum products showed marked corrosion, but in other brines little or no effect was noticeable. Weight losses and much corrosion were found with iron, galvanized iron, and zinc in all brines. It was found in general that sodium brines were more destructive than calcium brines, that chromate treatment retarded corrosive action, and that with some metals, particularly aluminum, tin,

and zinc products, an alkalinity of 0.05 per cent intensified corrosion.

Studies of Grapes in Cold Storage, F. J. De Villiers (South African Journal of Natural History, 6 (1929), No. 4, pp. 315-329). —In this study of the factors influencing the keeping of grapes it was found that natural variability in a single variety grown in a given location was such that 127 bunches, or about 8 boxes, to a single sample were necessary to give significant results in making comparison. Dividing grapes into three classes as regards maturity, namely, greenish, ripe, and ripe +, it was observed that neither the greenish grapes nor the ripe + kept as well as those in ripe condition. The greenish grapes failed to sweeten in storage and wilted readily. Analyzing the three classes, there was found a marked decrease in titrable acidity with maturity with very slight H-ion changes, due apparently to the buffer action of the cell sap. There was a close parallelism between acidity changes and respiration rate. Katabolism was evidently much higher in the immature fruit. The inferior keeping quality of the ripe + grapes is ascribed in part to the decrease in pedicel attachment which probably allowed the entrance of fungi.

The place of production was a factor in storage, also variety and the manner in which the pedicel was attached. Studies of chemical composition of grapes showed no significant differences due to soil, nor was any correlation observed between chemical composition and good keeping qualities. The apparent inherent keeping quality of varieties is associated with the impregnation of the cell walls with pectic bodies or intercellular apposition of pectic substances which not only give firmer structure but probably increase the reserves for metabolic activity.

Grapes picked in the morning kept best. Slight wilting before packing proved beneficial, especially in tender varieties. Porous sulfite paper proved a satisfactory wrapping medium. Grapes reached their highest turgidity just before sunrise and their lowest about 2:00 p. m. The rapid loss of turgidity was found due to the leaves drawing on the fruit for moisture. Ripe grapes suffered least on account of their higher osmotic concentration. It is assumed that the vine is unable to conduct sufficient water at such times. Rain during harvest caused bursting of berries, especially of the thick-skinned varieties. The two principal factors concerned in bursting are deemed to be elasticity of the skin and the osmotic pressure of the pulp cells. Such cracking usually occurred across sunburn or russet spots.

The rate of respiration varied directly with temperature; hence storage temperatures decreased the draft on reserves. The relation between temperature and respiration was found to be fairly constant, irrespective of variety. It is pointed out that low temperature also retards and in many cases inhibits the growth of fungi. For example, common mold showed maximum growth at 27 degrees (Centigrade) and very slight at 0 degrees. Grapes having a high acidity or high tannin content in the subepidermal layers were less readily injured by fungi.

In a study of the effect of low temperatures on grapes, two varieties, Rosaki and Raisin Blanc, were placed in an air bath at —10 degrees. It was observed that grapes were very sensitive to low temperature, being injured at less than 32 degrees (Fahrenheit). Undercooling had no harmful effects when the fruits were slowly warmed. Chemical analysis failed to show any appreciable reduction in acidity in cold storage, and the sugar-acid ratio was only slightly disturbed. It is concluded that the loss of quality in storage is due to the absence of aromatic esters, which, the author believes, are not manufactured at low temperature. The appreciable loss of water in storage caused an increase in the percentage of sugar and acids. The Hanepoot variety kept from 2 to 3 months and the Rosaki 3 to 4 months, after which there was a rapid breaking down. It is pointed out that an accumulation of carbon dioxide in storage results in the production of undesirable fruit substances, such as acetaldehyde and ethyl alcohol, which cause disorganization of the tissue.

Storage of Cut Seed vs. Whole Seed, J. S. Gardner (Potato Association Amer. Proc., 15 (1928), pp. 18-21).—Observations during seven years under practical conditions in Kentucky showed that where storage temperatures drop below the established minimum chilling affects cut seed more than whole seed. Whenever rot occurred in seed potatoes in cold storage, from whatever cause, the cut seed was much more affected than seed stored whole. Brine drip from broken coils in the storage rooms and also rain water splashing in through open ventilators were seen to affect cut seed worse than seed stored whole. Cut seed was observed to lose from 4 to 6 per cent in weight in cold storage as against from 1 to 3 per cent in seed stored whole. While differences in previous cellar storage conditions may upset the relation slightly, the whole stored seed have shown a consistent superiority in yield over seed stored cut.

The Drought of 1926-7 in Relation to Soil Moisture and Crop Yields at Goodwell, Okla., H. H. Finnell ([Oklahoma] Panhandle Station, Panhandle Bulletin 8 (1929), pp. 9-23, figs. 6). —The most severe drought during the years 1911 to 1928 at Goodwell covered the period from October, 1926, to May, 1927, during which the average monthly rainfall was 0.37 inches and resulted in complete failure of small grains. In the preceding year high yields were obtained from all types of crops. The performance of 14 crop rotations on silty clay loam soil for these 2 years of extreme conditions is presented.

The ability of the soil type to retain a large supply of moisture through protracted droughts was demonstrated. On land containing much available moisture deep tillage during the drought materially reduced the quantity present when the drought ended. The cropping previous to the drought affected the quantity of soil moisture present and carried through the dry period. Listed in the order of the quantity of soil moisture present in May, 1927, the cultures were summer fallow, cowpeas, corn, wide-spaced sorghum, close-spaced sorghum, small grains, sweetclover, and alfalfa. Cropping plans which maintained a soil moisture reserve through the drought of 1926-27 also carried through a good supply of nitrates. The highest average yields during 1927 came from rotations passing through the drought with moisture and fertility reserves and from rotations including large areas of adapted summer crops.

Book Review

"Five Years of Research in Industry" is a reading list of references to books and technical articles covering the past, present and future of various phases of industrial research. It is a booklet of 91 pages compiled by Clarence J. West, director of the research information service of its publisher, the Division of Engineering and Industrial Research, National Research Council. It is supplementary to a similar work "A Bibliography of Research," published in 1925. Papers giving the results of individual researches are not listed, as the booklet aims to list only papers which give information on the conclusions of America's leaders of research, the practical results achieved in their laboratories, their opinions on the relative values of cooperative and individual research, organization for research, and the philosophy and method of operation of research laboratories in specific industries. Incidentally it indicates fields of research in which little or no work is being done. References are given to books and general articles, engineering and nine of its specialized branches, three special classes of research and seventy divisions of industrial subject matter. Forty-two articles are listed under the heading of agricultural engineering and some additional articles by agricultural engineers are listed under various subject matter classifications. Orders may be addressed to National Research Council, 29 West 39th St., New York, New York, and should include funds to cover the cost of 50 cents per copy.

"Psychology for Advertisers," by D. B. Lucas and C. E. Benson will be of particular interest to agricultural engineers who are interested in advertising inasmuch as the senior author, Dr. Lucas, is a member of the American Society of Agricultural Engineers, is an agricultural engineering graduate of Iowa State College and formerly served as assistant professor of agricultural engineering at Rutgers University. The book presents scientifically sound theories on all of the important aspects of the psychology of advertising. It is divided into six parts with headings as follows: "The Mental Processes and Natural Tendencies of the Customer," "The Psychology of Appeals," "Constructing the Advertisement," "Mediums for Carrying Appeals to Customers," "Measurement of the Effectiveness of Advertising," and "Advertising and the Public." The volume also contains exercises for study and review, a bibliography and an index. In all there are 351 pages and 91 illustrations. Harper and Brothers list this book at $3.50.

"New Departure Ball Bearings" is a new manufacturer's handbook which will be of particular interest to designing engineers. An index page shows the types of bearings available and their general characteristics, and provides ready reference to the sizes, dimensions and capacities at various speeds for each type. There are also sections on "Selection of Bearing Size," "Bearing Mounting Information," "Equivalent Ball Bearing Sizes" and "Conversion Tables" to help the designer select bearings which most nearly meet his requirements. Any designer may obtain a copy free by writing to the New Departure Manufacturing Company, Bristol, Connecticut.

AGRICULTURAL ENGINEERING

Established 1920

A journal devoted to the advancement of the theory and practice of engineering as applied to agriculture and of the allied arts and sciences. Published monthly by the American Society of Agricultural Engineers, under the direction of the Publications Committee.

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The Society is not responsible for the statements and opinions contained in the papers and discussions published in this journal. They represent the views of the individuals to whom they are credited and are not binding on the Society as a whole.

Contributions of interest and value, especially on new developments in the field of agricultural engineering, are invited for publication in this journal. Its columns are open for discussions on all phases of agricultural engineering. Communications on subjects of timely interest to agricultural engineers, or comments on the contents of this journal or the activities of the Society, are also welcome.

Original articles, papers, discussions, and reports may be reprinted from this publication, provided proper credit is given.

RAYMOND OLNEY, Editor

R. A. Palmer, Assistant Editor

Noise and Personal Efficiency

NOISE, which engineers have for the most part considered an inconsequential by-product of the operation of their machines, has now been proven to measurably detract from the effectiveness of these machines as aids to human welfare and progress. The truth of the saying that "silence is golden" has been verified by psychology. We have run across some interesting observations on noise, its effect on people and what can be done about it, by Donald A. Laird, director of the psychological laboratory at Colgate University, in the November, 1929, issue of the Journal of Home Economics.

Noise stimulates, even in the most courageous men, an involuntary fear reaction accompanied by stimulation of abnormal adrenalin production, shift of blood distribution from the internal organs to the arm and leg muscles, a rise in blood pressure, temporary paralysis of the involuntary muscles, a halting of digestion and release into the blood from the liver of extraordinary amounts of sugar. As the fear reaction is usually unwarranted, under present conditions, and is not accompanied by unusual physical activity, it represents a waste of energy and lowers personal efficiency. Where persistent it inhibits growth and food consumption and develops a tendency toward habitual nervousness, high tension and restlessness.

Psychologists have not only observed and generalized on these effects; they have measured them. On a scale of uniform noise intensity units in which zero represents the point of inaudibility and 100 is intense enough to make the eardrums tingle, 40 units is a critical point above which noises induce the fear reaction and represent a drain upon body energy. This is about the intensity of noise on the inside of a high-grade closed automobile traveling forty miles per hour over smooth concrete. A trolly car makes around 60 noise units.

Houses, offices, factories and many machines used out of doors are unnecessarily noisy, both as to design and equipment. This situation can be corrected by eliminating the production of noise as far as feasible and by absorbing the balance above the allowable minimum. A factory has found it profitable to eliminate noise as far as possible. A real estate operator made money by creating a quiet subdivision. Silent electric refrigerators are the only kind that can be sold now days. Public health organizations are working to eliminate preventable noise and there is an early possibility of legislation in this direction.

Engineers have in the past been excusiably ignorant of the evil effects of noise. Now that these effects have been demonstrated, measured and published, continued ignorance of and indifference to the facts would be inexcusable. Minimizing of noise must largely be accomplished by engineering design and construction. The interest in public welfare which engineers profess demands their aggressive cooperation in subduing the pandemonium they have created.

Five Years of Research

SOME indication of how agricultural engineering research stacks up among other branches of engineering and industrial research, and of how agricultural engineers rate as authors and authorities on research, is given in a booklet, entitled "Five Years of Research in Industry." Published by National Research Council, it is a compilation of references to important literature on research in industry published within the past five years.

Agricultural engineers have not written any books or general articles on research or anything on cooperative, industrial or university research which the compiler considered worth listing. They have been doing some worthwhile pen pushing on research in their own and closely related fields. Under the heading of agricultural engineering the compiler has listed forty-two articles written by sixteen agricultural engineers and six authorities in agriculture and other branches of engineering. Also under the headings of agriculture, dairy science, electrical engineering, engineering, refrigeration, soils, and wood preservation he has listed writings of such agricultural engineers as Giese, Trullinger, Zimmerman, Walker, White, Boss, Ackerman, Bowen, McKibben, and Barr.

While agricultural engineering is only one of 87, or 1.15 per cent of the headings under which articles are listed in the compilation, the 42 articles listed under it are 2 per cent of the total of 2,091 articles listed. It is worth noting that only three branches of engineering outdo our own in the number of writings listed. They are gas engineering with 82 references, electrical engineering with 62, and highway engineering with 60. Automotive engineering rates only 32 references, engineering 36, steam engineering 32, sanitary engineering 20, marine engineering 10, and civil engineering 3.

Classifications rating the largest number of references are general articles and industrial research. Some branches of subject matter in which agricultural engineers are interested, and which have received considerable attention are cement and concrete, fuel, heating and ventilating, metallurgy, and refrigeration. Others which seem neglected are construction, dairy science, explosives, gas and oil engines, lubrication, mechanics, soils, wastes and wood preservation.

It would be dangerous to draw more than tentative conclusions from data such as these which may be influenced by the perspective of the compiler; and which do not take into account the research opportunities and needs of the various fields covered, the extent to which they overlap, their previous research history, the economic organization of the industries involved, the encouragement given to publication of articles of the type listed, or the amount and effectiveness of research actually in progress.

The comparison does tend to show that agricultural engineering has reached the state of development in which its leaders have a clear understanding of the direction of progress and the problems immediately ahead of them. They have made their vision a matter of record for the information and inspiration of all agricultural engineers. They have laid a foundation for the increased support and enlarged research program which must follow the increasing recognition of what has been and may be accomplished by the application of engineering to agriculture.

A. S. A. E. and Related Activities

Committee on Power Take-Off Revises Standards Recommendations

MEETING in Chicago, September 24, the A.S.A.E. Committee on Power Take-Off made an important revision in its previous recommendations for standards.

At the opening of the meeting H. D. MacDonald, engineer, International Harvester Company, submitted for consideration the idea of grinding a groove around the power take-off shaft, somewhere in the splined section, so that a hub could be retained on the shaft by one or two clamp bolts so placed as to intersect the groove. All present agreed that this would be more satisfactory from many standpoints than retaining the fitting by means of a nut on the shaft end, as previously recommended for the 1⅜-inch and 1¾-inch shafts. This arrangement would be easier for the farmer to use under field conditions, would require no special wrenches, would reduce the clearance required in universal joint forks, would not necessitate throwing the pivotal point of the universal joint further to the rear (a serious objection to the nut type of retaining means), and would reduce manufacturing costs. The concensus of opinion was that both the groove and the pin retaining means now commonly used on 1⅛-inch shafts, should be provided.

After a thorough discussion the committee went on record as having, for the time being at least, discontinued its attempts to draw up standards for a nut type of retaining means. It arranged to have detailed drawings made of the suggested retaining means, and to have copies sent to each committee member together with a suggested rewording of all points in the standard which hinge upon the retaining means design.

The committee agreed on several other changes to simplify and clarify various points in the standards and recommended practices it had previously drawn up. As soon as it has worked down to an agreement on details of the retaining means and contingent points it will be ready to submit its recommendations to the A.S.A.E. Standards Committee.

TENTATIVE PROGRAM

LAND RECLAMATION DIVISION
Of The
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS
WHITCOMB HOTEL, SAN FRANCISCO
CALIFORNIA

January 6 and 7, 1931

Forenoon Session — Tuesday, January 6

Frank Adams, Presiding

Welcome — B. B. Meek, director, California State Department of Public Works

"Reclamation and Development in the Sacramento-San Joaquin Delta" — Geo. A. Atherton, general manager, California Delta Farms

Luncheon

Business Meeting, Reclamation Division — L. F. Livingston, chairman

Business Meeting, Pacific Coast Section — W. L. Paul, chairman

Afternoon Session — Tuesday, January 6

"The Conservation of Public Domain" — Speaker to be provided by Hon. Ray Lyman Wilbur, Secretary of the Interior

"Economic Problems of Western Reclamation" — John W. Haw, director of agricultural development department, Northern Pacific R. R.

Banquet

L. F. Livingston, chairman, Reclamation Division, presiding

"Utilization of Water and Power from Boulder Canyon Project" —Dr. Elwood Mead, Commissioner of Reclamation (speaker tentative)

Forenoon Session — Wednesday, January 7

W. W. McLaughlin, Presiding

"Present Status of Facts and Opinions on the Relation of Forest Cover to Water Conservation"—E. I. Kotok, director, California Forest Experiment Station and Walter Mulford, professor of forestry, University of California

"Problems of Soil Erosion and How They are Being Met"—S. H. McCrory, chief, division of agricultural engineering, U. S. Department of Agriculture (speaker tentative)

"Influence of Reclamation on Design and Development of Farm Machinery" — B. D. Moses, vice-president, American Society of Agricultural Engineers, assoc. professor of agricultural engineering, University of California

Luncheon

Soil and Reclamation in China — Chas. F. Shaw, professor of soil technology, University of California

Afternoon Session

Woman's Part in Reclamation — Mae E. Schnurr, assistant to Commissioner of Reclamation

Financing Reclamation — H. D. Ellis, president, Federal Land Bank of Berkeley

Discussion led by — Walter D. Wagner, Commissioner of Reclamation Financing — Western Region, American Farm Bureau Federation

American Engineering Council

ONE hundred thousand questionnaires were recently mailed to engineers who may be eligible for listing in a new edition of "Who's Who in Engineering," to be published by Council. Requirements for inclusion established by the committee in charge of this work are ten years of active practice in the profession, in at least five of which the candidate should have been in charge of important engineering work. It is estimated that nearly 20,000 engineers will be eligible.

The last edition of this volume is five years old and a new one is urgently needed by banks, trust companies, government officials and others who use it as a guide in selecting candidates for and making appointments to important engineering positions.

The Administrative Board of American Engineering Council will hold its fall meeting in the Mayflower Hotel, Washington, D. C., October 17-18. The usual reports from the President, Executive Secretary, Treasurer, etc., will be received and the Board will determine the apportionment of delegates to the Assembly and approve the delegates selected by the various member organizations.

Consideration will be given to such legislative measures as river and harbor procedure, engineering experiment stations, moving expenses for government civilian engineers, toll bridge legislation, scientific medal of honor for government employees, water resources, flood control and government reorganization.

Necrology

Robert Grier Hemphill, irrigation engineer, U. S. Department of Agriculture, passed away June 19 at the home of his mother at Abbeville, South Carolina. He had been associated with the Department in various capacities since 1906. Since 1920 he had been in charge of irrigation investigation in Texas under a cooperative agreement between the U.S.D.A. and the Texas Board of Water Engineering. He became a member of A.S.A.E. in 1922.

Personals of A.S.A.E. Members

U. S. Allison has been appointed assistant professor in the department of agricultural engineering, A. & M. College of Texas.

R. H. Driftmier has succeeded S. P. Lyle as chief of the division of agricultural engineering at the University of Georgia, Athens. Mr. Driftmier was more recently professor of agricultural engineering at Kansas State Agricultural College.

K. J. T. Ekblaw has resigned as vice-president of Frank B. White Company to become associated with the Acme Sound Products Corporation, Chicago, with which organization he will be responsible for the extension of the use of sound motion pictures in the farm equipment field.

A. H. Hoffman, agricultural engineer, California Agricultural Experiment Station, is author of a short article entitled "Dusts Used for Testing Air Cleaner Efficiency," which is featured in the July issue of "Hilgardia" a journal of agricultural science published by the Station.

S. P. Lyle has been appointed as senior agricultural engineer in the U.S.D.A. Division of Agricultural Engineering, to devote special attention to agricultural engineering extension. Until his appointment he was head of the department of agricultural engineering at the University of Georgia, being succeeded in that capacity by R. H. Driftmier.

Howard Matson, until recently extension architect, Kansas State Agricultural College, has been appointed an instructor in agricultural engineering to assist with the preparation of circulars and farm building plans at the University of Kentucky, Lexington, and will be associated with J. B. Kelley.

S. H. McCrory, chief of the division of agricultural engineering, U.S.D.A. Bureau of Public Roads, and a past-president of A.S.A.E., was recently named a member of the advisory committee on the new National Hydraulic Laboratory authorized by Congress.

J. E. Waggoner has been appointed sales promotion manager of Oliver Farm Equipment Company. He was recently manager of the public relations division of the sales department of Delco-Light Company. His present business address is 400 West Madison Street, Chicago, Illinois.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the September issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Ralph H. Allee, graduate student, California State College of Agriculture, Sacramento, Calif.

Clarence O. Bennett, rural service representative, Niagara, Lockport & Ontario Power Co., Batavia, N. Y.

Almeron M. Frost, manager, agricultural sales, Pacific Gas & Electric Co., San Francisco, Calif.

Lionel W. Kirkman, student in experimental department, Cockshutt Plow Co., Ltd., Brantford, Ontario, Can.

David P. Livingston, advertising department, Meredith Publishing Co., Des Moines, Ia.

Ralph Piper, assistant engineer, Wisconsin Michigan Power Co., Appleton, Wis.

Transfer of Grade

James D. Swan, training course, J. I. Case Co., Syracuse, N. Y. (Student to Junior Member.)

Earl T. Swink, graduate student, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. (Student to Junior Member.)

New A.S.A.E. Members

William H. Carter, junior agricultural engineer, Bureau of Public Roads, U. S. Department of Agriculture, Washington, D. C.

Kenneth R. Frost, assistant agricultural engineer, University of California, Davis, Calif.

H. J. Gallagher, assistant professor of agricultural engineering, Michigan State College, East Lansing, Mich.

Olin M. Geer, experimental engineer, J. I. Case Company, Racine, Wis.

Warner M. Held, engineer, New Departure Mfg. Co., Chicago, Ill.

Boyce W. Knight, vice-president, Ensign Carburetor Co., Chicago, Ill.

Morris H. Lloyd, rural service director, Buffalo, Niagara & Eastern Power Corp., Buffalo, N. Y.

Carl Oberlin, vice-president, Martin Steel Products Co., Mansfield, Ohio.

Vladimir A. fon Reimers, military engineer, Bethlehem Shipbuilding Corp., San Francisco, Calif.

Transfer of Grade

Sydner H. Byrne, instructor, Virginia Polytechnic Institute, Blacksburg, Va. (Student to Junior Member.)

Floyd P. Trent, instructor, Virginia Polytechnic Institute, Blacksburg, Va. (Student to Junior Member.)

Employment Bulletin

An employment service is conducted by the American Society of Agricultural Engineers for the special benefit of its members. Only Society members in good standing are privileged to insert notices in the "Men Available" section of this bulletin, and to apply for positions advertised in the "Positions Open" section. Non-members as well as members, seeking men to fill positions, for which members of the Society would be logical candidates, are privileged to insert notices in the "Positions Open" section and to be referred to persons listed in the "Men Available" section. Notices in both the "Men Available" and "Positions Open" sections will be inserted for one month only and will thereafter be discontinued, unless additional insertions are requested. Copy for notices must be received at the headquarters of the Society not later than the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. There is no charge for this service.

Men Available

AGRICULTURAL ENGINEER with eight years teaching experience now employed at a good position desires a change of location preferably in the South. Interested in teaching but will consider any work pertaining to agricultural engineering. Have had special experience in farm shop, farm machinery, county agent work and as a writer. Thoroughly familiar with all general and special agricultural problems common in the South. Age 34. Married. MA-182.

RURAL ELECTRIFICATION ENGINEER desires position as manager of a rural department or opportunity to organize a new rural department for a public utility company. Has had teaching and extension experience for nine years and is now in charge of rural development in a branch office of a large utility company. Has had three years experience in rural electrification. Training and experience in rural organization and farm problems make him very capable. Holds a degree from a large state university. MA-183.

RURAL ELECTRIFICATION ENGINEER, with bachelor of science degree from an eastern state college in 1928, now employed as rural electrification engineer by a public utility in the East, desires a change of location. Experience in all farm operations and two years experience in rural electrification. Besides the college degree has taken a rural electrification short-course with General Electric Company. Would be interested in college or experiment station research work in rural electrification, or as rural electrification engineer with a public utility. MA-184.